"Sugar, Spice and Everything Nice"?
Risk Factors for the Continuity of Pre-school Conduct Problems and an Investigation of Gender Differences: A Longitudinal Study

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To Mum and Dad

Abstract

The primary aim of this study was to identify the "risk factors" associated with pre-school conduct problems and their stability over a year, to help increase the accuracy of "early risk" classification. 218 3-year-old children (105 boys, 113 girls, mean age 42.5 months) were recruited from 7 nurseries in disadvantaged areas of London. 72 of the children (30 boys, 42 girls) were identified by parents and/or teachers as "at risk" for conduct problems. 48 children (23 boys, 25 girls) were classified "low risk" by both parents and teachers. "At risk" children displayed poorer verbal ability and social skills, and more hyperactivity than "low risk" children. "At risk" boys showed poorer theory of mind skills, more hyperactivity, and a trend towards lower non-verbal IQs than "at risk" girls. Across the whole sample, verbal ability was negatively associated with conduct problems, independently of hyperactivity. In contrast, hyperactivity was independently negatively associated with a wider range of cognitive processes. A non-significant tendency emerged towards stronger negative associations between cognition and conduct problems for boys than girls.

A year later, at age 4, 156 children were followed up (73 boys, 83 girls), including 51 of the "at risk" children (21 boys, 30 girls) and 32 of the "low risk" children (15 boys, 17 girls). The "at risk" group still displayed poorer verbal ability and social skills, and more hyperactivity, than the "low risk" group, as well as poorer non-verbal IQs. However, the "at risk" group were no longer functioning below the population average range. 50% of the "at risk" group, including equal numbers of boys and girls, still met criteria for risk. "At risk" boys continued to show poorer theory of mind and a trend towards poorer non-verbal IQs than "at risk" girls, and also poorer inhibition. Across the sample, no cognitive predictors of conduct problems emerged independently of hyperactivity, whilst again a more pervasive profile of independent cognitive correlates of hyperactivity emerged. Hyperactivity and conduct problems were more strongly associated for boys than girls at age 4, whilst hyperactivity at age 3 was the strongest predictor of age 4 conduct problems for boys and girls alike.

In sum, individual differences in levels of hyperactivity emerged as more pervasively negatively associated with cognition than did conduct problems. Hyperactivity also accounted for many of the risk factors associated with being "at risk" for conduct problems, differentiated "at risk" boys from "at risk" girls, and was the strongest predictor of conduct problems a year later. Co-morbid hyperactivity may thus be an important factor in determining risk for enduring conduct problems, and in accounting for the greater prevalence of "life course persistent" antisocial behaviour amongst males.

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1

Introduction

"They engage in activities which are, in adult terms at least, almost exclusively anti-social. They shout a lot. If thwarted or annoyed, they are capable of kicking, punching and hair-pulling. Some even bite. So how do you spot the future yobs in a room full of tots who all seem to be auditioning for a junior version of the World Wrestling Federation?"

Tim Dowling, The Guardian, Wednesday 24th April, 2002

The above quote was written in response to the home secretary David Blunkett's speech at the Parent Child 2002 conference, in which he outlined a proposal to monitor nursery children's behaviour in order to identify the criminals of tomorrow. In the speech he declared that:

"The reality is that in many of our housing estates in many of our disadvantaged communities, a handful of those whose lifestyles and behaviour so disrupt the well-being of others, are creating havoc."

The home secretary proposed that the best way to combat the "havoc" created by the antisocial few would be to identify potential criminals as early as possible, and to invest resources in interventions designed to prevent the onset of an antisocial and criminal lifestyle. It is certainly true that older children with established antisocial behaviour do not tend to respond well to intervention, and prognosis for these children is often poor (Kazdin & Wassell, 1999). However, as Tim Dowling's quote illustrates, identifying the would-be offenders of the future amongst three-year-olds might prove a difficult task given that disruptive behaviour in the pre-school period could be deemed to a certain degree developmentally appropriate (Campbell, 1995).

David Blunkett himself made reference to the fact that only a handful of families partake in criminal activity, and thus whilst it may be true that many offenders had childhood histories of antisocial behaviour (Farrington, 1995), it is also the case that most young children with behaviour problems will not go on to become serious offenders (Campbell, Shaw & Gilliom, 2000). This is therefore the conundrum that psychologists face: Older children with established behaviour problems are notoriously difficult to treat. However, what constitutes behaviour which is not developmentally appropriate for a three-year-old, and under what circumstances might these behaviour problems be expected to persist or worsen with development? Only when these questions are answered can David Blunkett's criminals of tomorrow be distinguished from those whose behaviour simply reflects a normative developmental stage.

1.1 Structure of thesis

This thesis begins with an introduction to early conduct problems and the risk factors predictive of poor long-term outcome, as well as issues concerning gender differences in the prevalence and developmental course of conduct problems over time. Attention is also given to the extent to which cognitive, social or behavioural problems associated with conduct problems might be attributable to co-morbid hyperactivity, and thereby theories pertaining to the core deficits associated with hyperactivity are considered and discussed.

This thesis pertains to a sample of 218 pre-school children (mean age 42.5 months) recruited from nurseries in the Camden and Islington boroughs of London, which have a high index of identified need. Thus it was anticipated that a high proportion of children "at risk" for conduct problems would be identified. Data regarding the behaviour, social skills and cognitive functioning of the sample were collected from parents, teachers and by direct testing. The children were then followed up a year later and the measures were repeated.

In chapter 2, cross-sectional data drawn from the first part of the longitudinal data set are presented to address questions about the presentation of a sub-group of pre-schoolers from the above sample, deemed "at risk" for the development of later conduct problems based on behavioural ratings by parents and teachers. Their profile on a set of pre-determined "risk factors" for severe or persistent conduct problems are compared with the profile of a group of relatively "low risk" children with no early signs of conduct problems. Pre-determined "risk factors" are based on previous literature, and relate to the children's functioning across a number of domains. These consist of cognitive ability (non-verbal IQ and verbal ability), key aspects of executive functioning and social understanding (inhibitory control and theory of mind), and behaviour other than conduct problems, incorporating negative behaviours (hyperactivity) and positive or pro-social behaviours (social skills). Any such differentiation between the "at risk" and "low risk" groups with regard to risk factors would be consistent with the notion that conduct problems identified at age 3 might indicate cause for concern in terms of the potential for later problems, rather than reflect a transitory developmental stage. In addition, gender differences in both the prevalence of "at risk" status and in the risk factor profiles for girls and boys within the "at risk" group are investigated.

Following these cross-sectional categorical or "extremes" analyses, chapter 3 focuses on dimensional associations across the sample as a whole. Research questions pertaining to the association between areas of cognitive functioning considered as "risk factors" in chapter 2 (non-verbal IQ, verbal ability, inhibitory control and theory of mind) and conduct problems across the whole sample will be addressed. The extent to which the "risk factors" associated with extreme levels of conduct problems also apply to more general individual differences across a population can then be determined. In other words, is the association between putative risk factors and extreme conduct problems specific to "extreme" conduct problems, or does it simply reflect a more general association between risk factors and conduct problems, regardless of the severity of the behaviour? Furthermore, in order to help distinguish between areas of cognitive functioning which are specifically associated with conduct problems and those associated predominantly with hyperactivity, whole-sample associations are also conducted between the cognitive measures (non-verbal IQ, verbal ability, inhibitory control and theory of mind) and hyperactivity ratings.

Following the presentation of cross-sectional data, longitudinal research questions are addressed drawing on 1-year follow-up data. In chapter 4, the "at risk" group are re-visited at age 4 and the extent to which they continue to differ from the "low risk" group in terms of risk factors is examined. The extent to which gender differences in risk factor profiles within the "at risk" group are maintained is also considered. Furthermore, we investigate the proportion of the "at risk" group who still meet criteria for "risk-ness", in terms of parent and teacher-rated conduct problems, and those who no longer meet the criteria, at age 4. These children are labelled "persisters" and "desisters" respectively, and their risk factor profiles at age 3 are compared to establish whether any markers were identifiable at age 3 that could predict whether they would go on to be a "persister" versus a "desister" a year later. The risk factor profiles of persisters relative to desisters at age 4 are also compared. This enables consideration of the extent to which persistent conduct problems over the course of a year, at this early age, are associated with poorer performance in other areas of functioning at age 4, in contrast to children whose conduct problems desisted.

Chapter 5 presents cross-sectional data at age 4 pertaining to the whole-sample associations between cognition and conduct problems, and cognition and hyperactivity. Therefore the chapter aims to determine whether associations reported at age 3 in chapter 3 are replicated at age 4. Chapter 6 represents longitudinal data from age 3 to age 4 across the sample as a whole, i.e. dimensionally. First it addresses the associations between dimensions of cognition at age 3 and levels of conduct problems at age 4. Second, it examines dimensions of cognition at age 3 and levels of hyperactivity at age 4.

Subsequently, chapter 7 examines gender differences in the predictive power of risk factors in explaining variance in conduct problems. Here we focus on hyperactivity, non-verbal IQ and verbal ability, and examine gender differences in associations between these dimensional "risk factors" across the whole sample, and the dimensional measures of conduct problems across the whole-sample variations. These analyses are conducted cross-sectionally at age 3, cross-sectionally at age 4, and longitudinally from age 3 to age 4, thus enabling us to address the question of whether hyperactivity, non-verbal IQ, verbal ability and conduct problems are differentially associated in boys and girls at age 3 and age 4, and whether these 3 factors at age 3 are stronger predictors of later conduct problems (at age 4) for boys relative to girls.

Finally, chapter 8 aims to consolidate the findings from all chapters towards a model of early conduct problems. The model seeks to outline the concurrent "risk factors" which are present alongside early-emerging conduct problems, and the extent to which these risk factors: a) are stable across the course of a year, b) predict continued conduct problems a year later, c) apply equally to boys and girls, d) apply equally to conduct problems above a given threshold and to wider variations in levels of conduct problems seen across the whole sample, and e) are associated specifically with conduct problems and not attributable to co-morbid hyperactivity. Further, the chapter shall discuss the value of early identification of conduct problems, and the extent to which this thesis is consistent with the conjecture that severe and enduring anti-social behaviour could be reliably identified as early as age 3. Finally, limitations of the study and clinical implications of the findings are discussed.

Strengths of the study include the age group of the sample, which at age 3 is amongst the youngest used to investigate the research questions of interest. Furthermore, the fact that several informants of behaviour were used is a strength of the study: Parents, teachers and experimenters rated the behaviour and social skills of the children, and therefore data is available concerning children's behaviour across different settings. Another strength of the study is in its inclusion of positive, pro-social behaviours and their association with conduct problems, as well as the more commonly studied negative behaviour profile of hyperactivity. Few studies have measured neuropsychological processes in children as young as 3-years-old in association with conduct problems, and therefore the fact that the present study measured children's performance on tasks tapping both theory of mind and inhibitory control is another novel aspect of the study. Within the literature on conduct problems and antisocial behaviour and the association with deficits in cognitive functioning, little has been presented to disentangle the relative importance of verbal versus non-verbal ability in determining risk for severe or enduring conduct problems. This study measures aspects of the two constructs separately in order to investigate which is more strongly associated with conduct problems. Further, the study gives serious consideration to issues of co-morbidity between conduct problems and hyperactivity and attempts to delineate the specific aspects of cognitive functioning associated with conduct problems which are not attributable to the co-morbidity of the two behaviour profiles.

Several aspects of the design are also novel. Firstly, the sample is drawn from a particularly deprived population with high risk for conduct problems, making the level of conduct problems to be studied higher than might be typical of many populations. Secondly, the data-set is large due to both the number of measures and the number of children in the sample (N=218), thus a high degree of power to detect associations and trends is afforded. To place this in context of the relevant literature, compared to other longitudinal studies looking at similar issues, the size of the sample compares favourably (e.g. Richman, Stevenson & Graham's (1982) Waltham Forest Study: N=212; Nigg, Quamma, Greenberg & Kusche's (1999) longitudinal study: N=235), although some of the larger-scale longitudinal studies have recruited many more children (e.g. Dunedin Epidemiological Study (Silva, 1990): N=1000; West & Farrington's (1973) Cambridge Study in Delinquent Development: N=411). Thirdly, the longitudinal element of the design is a strength given the limited number of prospective studies looking at the continuity of conduct problems in a sample so young. This may help determine the mechanisms which might underlie enduring conduct problems and the different developmental trajectories of boys and girls. Finally, the study considers the extent to which associated risk factors at extreme ends of the behavioural spectrum with regard to conduct problems also apply to the wider variations in levels of conduct problems across the whole sample. Thus, the study can contribute to our understanding of the nature of conduct problems: Are severe levels of conduct problems qualitatively different from lower, "normative" levels of conduct problems? Or are they in fact merely quantitatively different, i.e. the impairments associated with "severe/ extreme" conduct problems relate to the same areas of functioning that are associated with normative variations in levels of conduct problems, but are simply more extreme deficits? Answering this question could have important implications for clinical interventions, determining whether similar intervention strategies could be aimed at reducing levels of aggressive or anti-social behaviour in community settings as those used in clinical settings to treat conduct disorder.

1.2 Early conduct problems: Definition and prevalence

Aggression and impulsivity are amongst the most persistent forms of childhood maladjustment (Institute of Medicine, 1994), and there is much evidence in the literature in support of the notion that early emerging problems show considerable continuity across the life span (e.g. Farrington & West, 1993; see section 1.3 below). The implications of long-term conduct problems can be of great financial and emotional cost to the individuals affected and their families as well as society at large, not least due to the likelihood of long-term involvement of mental health services and criminal justice systems (Loeber, 1982). Conduct problems are associated with a host of negative outcomes including academic failure, peer rejection, family conflict and adult criminality (Kazdin, 1995).

It is clear that early identification of conduct problems is an important starting point towards addressing the problems associated with enduring antisocial behaviour across the lifespan. Nevertheless, Campbell (1990) recognised that some stringent guidelines were needed for the diagnosis of clinically significant problems in pre-school children, given their transitional developmental stage and likely associated behaviour problems. To address the issue of appropriate diagnosis in young children, Campbell (1990) put forward several criteria necessary for the definition of a disorder in a child. Firstly, a constellation of symptoms characteristic of a given disorder should be present. These symptoms should be stable at least short-term, beyond a stressful life event period (e.g. birth of a new sibling) or developmental transition (e.g. starting nursery school). The symptoms should be pervasive (i.e. present across more than one context, e.g. playgroup and at home). They should be severe; and they should impede development to the extent that impairment in functioning is indicated. As Campbell (1990) noted, the ability of the parents and/or family to support the child through difficult transitions such as the birth of a new sibling could in part determine whether the difficult behaviour is merely a transitional phase or whether it develops into more long-term problems.

Established criteria do exist for the diagnosis of disorders (DSM-IV, American Psychiatric Association, 1994; ICD-10, World Health Organisation, 1992). Behaviour disorders most commonly diagnosed in childhood fall into three main categories: Attention Deficit/Hyperactivity Disorder (AD/HD), Conduct Disorder (CD) and Oppositional Defiant Disorder (ODD). The distinguishing feature of AD/HD is a persistent pattern of inattentive and/or impulsive and hyperactive behaviour which is above the level commonly expected of a typically developing child of comparable developmental level. Age of onset is rarely younger than 4 or 5 years of age (DSM IV,1994; APA, 1992).

Consistent with the suggestions put forward by Campbell (1990) there are a number of criteria these symptoms must fulfil in order for a diagnosis to be appropriate. For example, six or more symptoms of hyperactivity-impulsivity need to be present and to have persisted for a period of at least 6 months. Symptoms should be present in two or more settings, and should not occur exclusively during the course of any other disorder (e.g. schizophrenia) or be better accounted for by any other mental disorder such as mood disorder or anxiety disorder (DSM IV, 1994).

Given that the aim of the present study was to investigate precursors and predictors of the most serious outcomes in young children presenting with early behaviour problems, the focus of this study will be on conduct rather than AD/HD symptoms. Findings from previous research suggest that conduct problems rather than AD/HD are predictive of more serious forms of later offending such as violent crimes and crimes against people (Babinski, Hartsough & Lambert, 1999; Mannuzza, Klein, Konig & Giampino, 1989).

CD is characterised by "...a persistent pattern of behaviour in which the rights of others, or developmentally appropriate moral or societal rules of conduct, are violated" (DSM IV; APA, 1994). Onset of CD can occur as early as the pre-school years but significant symptoms are rarely evident prior to middle childhood (DSM-IV; APA, 1994). Behaviours related to conduct disorder fall into four main groupings, aggressive conduct involving the threat of physical harm to people or animals, non-aggressive conduct referring to damage to property, deceitfulness or theft, and serious rule violation. Again, many of Campbell's criteria are included here, for example the disturbance in behaviour must be sufficient to have caused significant impairment in social, academic or occupational functioning and symptoms must have been present during the past 12 months (DSM IV; APA, 1994). Nevertheless, it would be inappropriate to consider that symptoms emerging as early as the pre-school years could constitute a diagnosis of full-blown conduct disorder. Moral reasoning is still developing at this age (Kohlberg, 1982), and hence it would be difficult to determine to what extent violations of such internalised norms could be violated. Essentially the aim of monitoring the behaviour of three-year-olds is to identify potential indicators of early risk for the later development of disorders like CD.

The presentation of conduct problems in the pre-school period is likely to more closely resemble ODD. ODD includes many of the features associated with CD, such as disobedience and opposition to authority figures, but differs in that the more serious violation of the rights of others and of age-appropriate moral and societal norms are not present. ODD is often referred to as a precursor to the later onset of CD. It is worth noting that the term "precursor" used in this context might indicate one of two processes. Either that ODD develops into CD such that CD is merely a later expression of ODD, or that ODD exposes children to experiences or situations that place them at risk for developing CD. Either of the described mechanisms might account for the association between the two disorders. As with the diagnostic criteria of the other childhood behaviour problems, the behavioural symptoms must occur more frequently and with more serious consequences than would be expected for the developmental level (DSM IV; APA, 1994).

Nevertheless, despite the fact that ODD offers a more appropriate behavioural profile for pre-school children, the reliance on behavioural ratings alone in this and many other research studies in the absence of a full clinical assessment taking into account Campbell's recommended criteria, it is not appropriate to suggest that the behaviour of these children constitutes a diagnosis of ODD.

Generally speaking, behaviour that resembles symptoms of ODD is taken as evidence of early risk rather than early diagnosis of behaviour or conduct disorders.

Having established the nature of the symptoms which are present in behaviour disorders, and when those symptoms might be indicative of clinically relevant problems, how common are behavioural disorders in the child population? Disorders of conduct (incorporating both ODD and CD) are the most common form of psychiatric disorder in the western world, with a prevalence rate of between 5 and 10% for children aged between 8 and 16 years (Hill, 2002). The consensus from a number of studies (e.g. Cornely & Bromet, 1986; Koot & Verhulst, 1991; Richman, Stevenson & Graham, 1982) is that around 10-15% of pre-school children have mild to moderate problems. However, rates of disorders from studies such as these could overestimate the prevalence since they selected children on the basis of behaviour checklists as opposed to formal diagnoses based on the aforementioned criteria. Indeed, one of the problems with selecting samples as young as preschoolers is that whilst behaviour checklists of diagnostic criteria can be accurate tools for diagnosis in older children, many of the behaviours in question may be considered normative in younger children.

What, then, is the likelihood that conduct problems identified in childhood will persist? Is there any evidence that attempting to identify potential problems at a young age is worthwhile?

1.3 Evidence for the continuity of early conduct problems: Longitudinal studies

1.3.1 Childhood predictors of adult antisocial outcome: an early retrospective study (Robins, 1978)

What is the prognosis for a child with behaviour problems? How enduring are the symptoms, and what is the typical developmental course of such problems? One of the first studies to investigate these questions was reported by Robins (1978). On analysis of the data from a variety of different samples, the following observations were made. Firstly, antisocial behaviour rarely arose for the first time in adulthood, and a childhood history of antisocial behaviour was almost always present. Secondly, even highly antisocial children only became highly antisocial adults in half or fewer cases. Thirdly, the variety of antisocial behaviour displayed as a child was a better predictor of adult antisocial behaviour than any single behaviour. Childhood behaviour emerged as a better predictor of adult antisocial behaviour than family background or social class. Finally, social class made little contribution to the prediction of (serious) adult antisocial behaviour (Robins, 1978). However, much of the data from this study were gleaned from retrospective records, which might be considered unreliable. Nevertheless, many of the findings have been replicated in more recent, prospective studies discussed below.

1.3.2 Mid-childhood predictors of adulthood criminal activity: The Cambridge Study in Delinquent Development (West & Farrington, 1973)

Another series of studies to investigate the long-term course of behaviour problems identified in childhood was the Cambridge Study in Delinquent Development, described in 4 books (West, 1969, 1982; West & Farrington, 1973, 1977) and in over 60 papers listed by Farrington & West (1990). The study was a longitudinal study of 411 boys from London, and was a predominantly white, urban, working class sample of British origin. The boys were followed up periodically from the age of 8 up to 32. Data collection took place at age 8-9, 10-11, 14-15, 18, 21, 25 and 32, during which time a variety of factors were measured which were hypothesised to be related to or play a causal role in offending, as well as self-reported and official records of convictions and offending. The measures were obtained from parental interviews, teacher questionnaires and peer ratings, providing a detailed profile of the boys' environmental and social circumstances, academic achievements and individual personality characteristics.

Analysis of the data from the study revealed offending as merely one expression of a larger syndrome of antisocial behaviour. In general, there was a tendency for males to be versatile rather than specialised in their offending, with a high degree of continuity across the life span. This continuity was evident even in the face of changing circumstances, pointing to individual rather than situational causes. There was an underlying antisocial tendency amongst the boys who went on to offend, which was stable across the life span but expressed differently at different ages. One of the most striking illustrations of this continuity and stability was in the fact that half of all officially recorded offences were committed by 6% of families (Farrington, 1995).

What, then, are the childhood predictors of delinquency? Are children displaying the symptoms of behaviour disorders described earlier amongst those at risk? A variety of childhood factors at age 8-10 were found to independently predict delinquency and offending behaviour beyond adolescence. The best predictors at age 8-10 of convictions between the ages of 10 and 32 included troublesomeness, daringness, dishonesty, a behaviour problem sibling, a convicted parent, poor parental child rearing behaviour, low junior school attainment, poor housing and separation from a parent (Farrington, 1995).

However, there was a distinction made between "persisters" who became delinquent and continued along the same developmental pathway throughout the life span, and those who were "desisters" and did not continue to offend. A number of factors emerged as protective factors, predictive of desistence. Employment was one such factor, as were getting married and staying married, and moving away from London. Nevertheless, an alternative explanation for the findings may be that antisocial behaviour does not desist, but that it is expressed in a different way as a result of the opportunities offered by the "protective" factors. For example, spouse battery may replace assaults outside the home, which is less likely to result in a conviction yet is not indicative of a desistence from antisocial behaviour. Also worthy of note is that it may be the case with all of these factors that, even if a change in the expression of antisocial behaviour does not account for the observed desistence from crime, that these individuals would have desisted from crime anyway. Thus, the observed "protective" factors may be the result rather than the cause of desistence and tell us nothing about why certain individuals desisted whilst others did not.

Factors which might account for individuals who desist from crime have been considered, but what of individuals who show many of the identified risk factors at age 8-10 but who never go on to engage in criminal behaviour? The Cambridge study identified one in six of the boys as vulnerable at age 8-10, in that they possessed three of five adverse background factors identified at the beginning of the study (low family income, large family size, convicted parents, poor parental child rearing behaviour, and low nonverbal intelligence). Three quarters of these males were convicted of criminal offences up to the age of 32. However, the researchers were interested in the protective factors which might have played a role in diverting the other quarter of these vulnerable males from crime. It emerged that boys with few or no friends at age 8 tended to remain unconvicted, as well as those without siblings with behaviour problems or convicted parents at age 10. Nevertheless, unconvicted vulnerable men were not necessarily better adjusted or leading more successful lives. In fact it seems that their vulnerabilities simply led to problems other than antisocial behaviour, such as social isolation (Farrington, 1995).

Implications from this famous study are wide ranging, including implications for future research and psychological intervention, as well as for social policy implementation, such as early prevention programmes targeting low attainment, child rearing practices, and poverty (Farrington, 1995). Certainly the Cambridge Study in Delinquent Development offers some evidence for the continuity of behaviour problems from childhood throughout the lifespan, although the focus was primarily concerned with offending behaviour as an outcome measure. Further, the children were 8 years old at the beginning of the study, and only boys were considered. A longitudinal study which looked more generally at behavioural outcomes and followed children up from pre-school, whilst giving some consideration to the issue of gender differences, shall be discussed in the next section (Richman, Stevenson & Graham,1982).

1.3.3 Behaviour problems from pre-school to mid-childhood: The Waltham Forest Study (Richman, Stevenson & Graham, 1982)

In this study, a sample was drawn from a register of families in the Waltham Forest area. The children were 3 years old at the beginning of the study, and a "problem group" consisting of 101 children was identified from the main sample via a screening procedure including a behaviour checklist and clinical rating of disturbance. Matched controls were selected on the basis of age, sex and social class, who were not rated as disturbed (N=101). The children were followed up at ages 4 and 8. The question of interest was the outcome of disorders, as well as factors influencing outcome in terms of external influences (family, for example), and aspects of the child's own functioning, such as language development, which could act as risk or protective factors for the development or maintenance of disorders.

Measures collected at the follow-up sessions were concerned with family background, relationship quality, parental mental and physical health, stresses, social contact with family and friends, housing conditions, and contact with services. At the follow-up at 8 years, questions relating to school were also added, and teachers were asked to complete a behaviour questionnaire concerning the child's behaviour.

One of the first findings reported in the study distinguished between 5 types of disturbance at age 3 across the whole sample (which included both the problem group and the control group, as well as a small number of additional children selected for the presence of language delay alone). Firstly, a normal group with no problems was evident. Secondly, an otherwise normal group with nocturnal bladder incontinence was identified. The third group emerged as a disturbed group with a widespread incontinence problem not limited to nocturnal bladder control. The fourth group presented with a general disturbance with nocturnal bladder incontinence and conduct problems. Finally, a disturbed group with overactivity, food faddiness and restlessness was identified. It is interesting to note that no evidence of neurotic or emotional disturbance was found at this young age, although it is possible that the behaviour checklist used in the study did not include sufficient information regarding emotional problems (Richman et al 1982). Other similarities emerged within each group aside from patterns of behaviour. For example, the latter two groups tended to come from families in which there were higher rates of poor parental marriages, as well as higher ratings of lack of warmth, and highly critical mothers (all assessed by interviewer ratings of self-report).

In terms of outcome at ages 4 and 8 in the problem and control groups, marked differences emerged between the two groups. The behaviour problem group continued to show disturbance at home and at school at both 4 and 8 years. Meanwhile, the control group were scoring consistently higher on development, intelligence and educational attainment. Specific and general delays remained high in the problem group, especially in boys. The groups were also differentiated by external factors such as external stress, psychological distress in the parents (particularly mothers), marital relationship problems, and physical ill health in the parents, all of which were higher in the problem group.

In general, problems in the problem group tended to continue in the context of ongoing family adversity, although there was very little evidence that family adversity itself contributed to the maintenance of problems. It did, however, increase the likelihood that previously non-disturbed children would develop problems (Richman et al, 1982). The suggestion here is that exposure to family adversity might be predictive of later problems irrespective of whether or not the situation subsequently improves. This is not a promising concept with regard to interventions aimed at improving family circumstances. Possibly there is some critical period in the lifespan at which exposure to family adversity is most damaging. It is also possible that family adversity has a lasting impact on interactional processes amongst family members, and that it is this which is the cause of persistent problems. The latter interpretation would offer more hope for intervention initiatives.

Factors which predicted the persistence of problems in the problem group included severity of the initial disorder (with moderate and severe disorders more likely to persist than mild disorders), and restlessness and high activity levels. With regard to the development of problems in initially non-disturbed children, the following factors were found to play an important role. Early signs of problematic behaviour, even to a very mild degree, differentiated control children who later developed problems from those who did not, as did restless and active behaviour. Disharmonious family relations were also predictive of later problems in initially undisturbed children. Richman et al (1982) suggested that these findings highlight the need for continual monitoring of child behaviour, as opposed to one-off screening which might miss later-onset problems.

As Rutter (1965) noted, by later childhood, disorders are easier to classify, and tend to fall into one of two categories of disorder: conduct or emotional. Indeed, these did emerge as distinct categories in the analyses of outcome at age 8. Generally, similar numbers of boys and girls presented with emotional problems, with significantly more boys than girls presenting with conduct disorders. Overall rates of both type of disorder were higher in the problem group, with a higher proportion of conduct disorders reported across groups in comparison to emotional disorders.

Both conduct and emotional disturbances were found to be associated with earlier disturbance, whether assessed by clinical rating or behavioural questionnaire at age 3. Rates of earlier problems were similar in both conduct and emotionally disturbed children, although there were differences in the symptoms. Restlessness was commonly present in the background of conduct-disordered children, whereas fearfulness was characteristic of the emotionally disturbed children's background. Disharmonious family relationships were important in the development of both types of disturbance.

The finding that behavioural problems in children as young as 3 years of age are often predictive of further problems in middle childhood was a new finding, and extended previous work relating to the continuity of behaviour problems in older children and adolescents (Robins, 1978; West & Farrington, 1973,1977).

1.3.4 Continuity of behaviour problems from early childhood: more recent studies

Taking the lead from the above study, other research examining the course of behaviour problems identified very early in childhood, has confirmed Richman et al's findings with regard to the continuity of problems. Egeland, Kalkoste, Gottesman and Erickson (1990), for example, followed up a sample of high risk children from infancy to grade 3. According to teacher and parent ratings on the Child Behaviour Checklist (CBCL: Achenbach, 1991), children were classed as "aggressive and disobedient" or "withdrawn" and compared with a comparison group of children scoring in the normal range on the CBCL. Results indicated that a significantly higher proportion of the "aggressive and disobedient" children were rated above the clinical threshold (70 on the CBCL) by teachers at first and second grade in comparison with controls. This pattern was less evident by the third grade, however. Continuity was also less evident for the withdrawn group, although this may have been due to the fact that a comparatively small number of children were identified in this group (N=7). The results of this study can be taken as evidence for the continuity of behaviour problems at least short-term (up to second and possibly third grade), although conclusions cannot be made about the longer-term stability of behaviour problems.

The Dunedin Epidemiological Study is a longitudinal investigation of a representative birth cohort of children born in Dunedin, New Zealand between 1972 and 1973. The study is still ongoing, and is concerned with the health, development and behaviour of this cohort of children, and data relating to numerous areas of functioning have been collected periodically throughout the lifespan of the cohort since the children were 3 years old (see Silva, 1990 for a description of the cohort and study design). McGee, Partridge, Williams and Silva (1991) presented data describing the cohort from the age of 3 years through to 15 years. 2% of the sample at age 3 were rated as "very difficult to manage" by both parents and the examiner, and were referred to as the "pervasive" group. A further 3% of the sample were identified as "hard to manage" by the mother but not by the examiner. Both of these groups were rated as more problematic by mothers at school age (age 9), although only the children in the pervasive group were rated by teachers as showing more hyperactive and inattentive symptoms at follow-up sessions. Furthermore, at ages 11 and 15 years, 50% of the pervasive group met DSM III criteria for a disorder, as measured by a structured interview and multiple informant data. Indeed, only 25% of the originally identified problem group emerged as problem-free by adolescence, even if they did not meet the official criteria for a clinical disorder. More recent follow-up reports of the cohort in adulthood (e.g. Moffitt, Caspi, Harrington & Milne, 2002; described in more detail in section 1.4 below) have reported numerous negative outcomes for children with behaviour problems identified in childhood compared to those without significant problems as children, including mental health problems, criminal convictions and financial difficulties.

The consensus from all of the studies reviewed above seems to be that there is substantial continuity of behaviour problems or antisocial behaviour across the life span. This finding has prompted much speculation amongst researchers and clinicians alike, with regard to the value of identifying potential long-term difficulties as early as possible.

1.4 Early conduct problems: The importance of early identification

Whilst it is easier to identify significant conduct problems in need of treatment in older children with a longer history of difficulties, long-term prognosis is poor once problems are established (Kazdin & Wassell, 1999). In many children presenting with more advanced and serious forms of antisocial behaviour, there is often a reported history of difficulties spanning back as far as the pre-school years (Robins, 1978).

Moreover, not only is there an increased interest in the preschool period due to the greater likelihood of treatment responsiveness, but early onset problems might in themselves be conceptualised as qualitatively distinct from those with late-onset problems, predictive of more serious and enduring difficulties (Moffitt, 1993). Moffitt's theory is based on the observation that the prevalence of antisocial behaviour shows a dramatic but temporary increase during adolescence, with the hypothesis that this group of adolescent delinquents is made up of two distinct groups. The first group are referred to as *life course persistents* whose antisocial behaviour is a continuation of earlier displayed antisocial behaviour. This behaviour is likely to continue throughout the lifespan, and is seen as the manifestation of a pathological personality brought about by a transactional process combining biologically based neuropsychological deficits and a disrupted or "criminogenic" environment. These individuals are described as being prone to involvement in a wide variety of crimes, including those committed by lone offenders and violent victim offences. Moffitt (1993) asserted that life course persistent offenders are unlikely to desist since events such as marriage or employment could provide further opportunities for crime or exploitation. Moreover, past experiences might act as barriers against opportunities for adaptive change such that they may not be accessible even if the individual had the inclination to take advantage of them.

In contrast, *adolescence limited* individuals are believed to mimic delinquency as part of a normative process to cope with a temporary maturity gap. Their antisocial behaviour is limited to the adolescent period and involves acts associated with adult status or autonomy from adult control, such as running away, theft and substance abuse. These individuals are considered to be capable of taking advantage of and gaining access to opportunities for desistence. In a more controversial aspect of the theory, Moffitt (1993) suggested that teenagers who do not engage in antisocial behaviour either have pathological characteristics that exclude them from peer networks, or are faced with structural barriers preventing them from learning about delinquency. Alternatively they may have no experience of the maturity gap due to early access to adult roles or late puberty. Some evidence was also presented to illustrate that children who abstain from delinquency completely are less well adjusted than their temporary-delinquent peers, and tend to present with an enduring personality configuration characterised by tenseness, social isolation and a lack of interpersonal skills (Shedler & Block, 1990).

It certainly seems a controversial statement to suggest that adolescents who do not embark upon any form of delinquency are missing out on a normative developmental transition. Indeed, evidence was found to the contrary in the Minnesota High Risk Study testing Moffitt's hypotheses (Aguilar, Stroufe, Egeland & Carlson, 2000). In their follow-up of children from 0-16 years, the sample was divided into 4 groups: never antisocial, childhood limited, adolescent onset and early-onset persistent. In contrast to Moffitt's notions relating to adolescent-onset delinquents, Aguilar et al found that the adolescent-onset group reported significantly higher levels of internalising symptoms and life stress as adolescents than those who were never antisocial. This does appear to suggest that there might be something more serious than a normative process underlying adolescent-onset delinquency. Nevertheless, Aguilar et al did find evidence to support Moffitt's distinction between the two discrete pathways to antisocial behaviour, although prior to age 4 this distinction related only to psychosocial factors, and not to neuropsychological or temperamental factors as Moffitt (1993) had proposed. After 64 months, these factors did differentiate between early-onset persistent and adolescent onset individuals.

In general, Aguilar et al's study provided support for Moffitt's theory, in that there did appear to be a distinction between early and late onset pathways to antisocial behaviour, and that the two pathways did differ on a number of psychosocial factors. The sample was only followed up to age 16, and hence confirmation as to whether the adolescent-onset individuals were actually adolescence-limited delinquents was not determined. However, in line with Moffitt, the early-onset persistent group did appear to have the worst prognosis at least up to age 16.

A recent follow-up of children from the Dunedin longitudinal study who had been identified previously as childhood-onset and adolescence-onset delinquents reported findings relating to the outcome for the cohort at age 26 years (Moffitt, Caspi, Harrington & Milne, 2002). Consistent with Moffitt's (1993) theory, the childhood-onset delinquents emerged with higher scores relating to psychopathic personality traits, more mental health problems, greater degree of substance dependency, more children, more financial problems and work problems, and association with violent and drug-related crime in comparison with the late onset group. Nevertheless, the adolescent-onset group did not desist from crime altogether as would be predicted based on Moffitt's hypothesis that delinquency during adolescence is part of a normative developmental transition. The authors proposed that a plausible explanation for this contradictory finding could be that in the present day adolescence is extended such that the twenties no longer constitutes the adult status it once did. For example, financial pressures such as rising house prices delay independent living. This "emerging adulthood", according to Moffitt et al, reflects a new developmental stage in which the crime-promoting opportunities traditionally associated with adolescence, are prolongued. Further follow-up studies of this cohort of men will in time provide data to determine whether Moffitt et al's hypothesis is accurate. The important message from the study regardless of the outcome of future follow-up studies is that the prognosis for the early-onset group was indeed significantly poorer than the later-onset group.

Stevenson and Goodman (2001) illustrated that Moffitt's early-onset/persistent hypothesis could be applied to children as young as 3 years old, and to an outcome as severe as engagement in violent criminal activity in adulthood. Children originally participating in a longitudinal study of behaviour from age 3 through to age 8 (Waltham Forest Study; Richman, Stevenson & Graham, 1982) were followed up at age 23-24, and their criminal records relating to criminal convictions since the age of 17 were obtained from the Criminal Records Office. 81 of the 828 subjects (9.8%) were convicted of an offence in young adulthood (18.3% of males and 2.3% of females), of which 38 were violent offences, committed by just 26 individuals (6.5% of males and 0.2% of females). Significant predictors at age 3 of adult convictions were high levels of activity and management difficulties (read as hyperactivity and conduct problems in the present study). These remained significant predictors even when controlling for the potentially confounding effects of gender and social competency. Thus, it was not just that early hyperactivity and conduct problems were more common in boys, and boys were in turn more likely (regardless of their behaviour at 3) to engage in criminal activity in adulthood. Equally it was also not the case that early behaviour problems tended to co-exist with poor social functioning, and that the latter was responsible for the later offending rather than the early behaviour problems. In addition, temper tantrums at age 3, which might be considered a characteristic behaviour of early conduct problems, were predictive specifically of *violent* offending in early adulthood, again independently of gender and social competence. There also emerged a non-significant trend in the direction of management difficulties at age 3 predicting violent offending in young adulthood.

Research such as Moffitt's (1993), pertaining to the particularly poor outcome of children with early emerging conduct problems has influenced the focus of intervention initiatives in an important way. The implication is that mental health resources should be concentrated on these vulnerable children who appear to have the poorest long-term prognosis, and hence in recent years there has been an increasing emphasis on early identification and intervention (Reiss & Price, 1996).

This brings us back to the original point discussed in section 1.1: Labelling all children at age three presenting with early conduct problems "future delinquents" is likely to be problematic. The potential for false positive identification of children could result in unnecessarily stigmatising children who may not go on to develop significant problems. Furthermore, targeting intervention initiatives at all families of children displaying behaviour problems in the pre-school years might not be the most economical use of resources if only a handful of the families are in fact in need of help. Stevenson and Goodman (2001) reported in their study of the age 3 predictors of adult criminal activity that the positive predictive value was 19%. Thus, only 19% of the cases at age 3 identified as "at risk" in terms of the presence of behaviour problems actually went on to commit an offence by the age of 24. Given that the prevalence of criminal activity is low, it follows that indeed only a small proportion of "at risk" children in the pre-school period will in fact go on to engage in criminal activity. The 38 violent offences committed by adults in Stevenson and Goodman's (2001) study were committed by just 26 individuals, out of a total of 828 in the whole sample. This gives us some idea of the specificity with which one would have to be able to identify children in order to accurately predict the future offenders and thus to justify individual targeting of services at an early age.

Clearly the early identification of "risk" for later antisocial behaviour needs to be balanced against the potential cost of false identification. It is essential therefore to pinpoint more precisely the markers or risk factors that predict the continuity and increasing severity of early conduct problems, enabling more accurate assessment of potential difficulties in the pre-school period. In so doing, Bennett et al (1998) outlined the importance of considering the following issues when identifying risk: the potential for false early labelling of children, particularly girls; the value of obtaining several assessments across numerous time-points as opposed to reliance on a one-off screen; and the likely benefit of obtaining measures of neuro-psychological functioning and assessing family risk.

1.5 Risk factors associated with persistent or severe forms of conduct problems: An overview

Longitudinal studies have tended to agree that antisocial behaviour persists in the context of continuing adversity, for example impoverished social and economic environments, poor relationships with peers, teachers and parents, or low educational attainment (Campbell, Pierce, Moore, Marakovitz & Newby, 1996; Richman et al, 1982; Shaw, Gilliom & Giovannelli, 2000; West & Farrington, 1973). Thus it seems important to consider behaviour in the context of other associated risk factors.

A recent study reviewed by Campbell, Shaw and Gilliom (2000) used cluster analyses to identify children with "multiple risk", "child parenting risk", "neighbourhood risk" and "child and family risk" profiles at 1.5 years of age (Shaw, Winslow & Flanagan, 1999). Results revealed that children in multiple risk groups at time one were most likely to show the poorest functioning and behaviour problems over time. Thus Campbell et al (2000) concluded that "...risk that cuts across child, parenting, family and socio-demographic domains" is most likely to predict a continued pathway towards serious antisocial behaviour and externalising problems. Consistent with this notion, Toupin, Dery, Pauze, Mercier and Fortin (2000) asserted that the interaction between parent factors such as parenting style, environmental factors such as family adversity, and child factors such as cognitive profiles should be considered in any model explaining the origins of conduct problems.

For the purposes of the present study, the focus is primarily concerned with child risk factors, which shall be reviewed in more detail in section 1.6. However, to place the child risk factors in the context of the wider picture of risk factors, a brief discussion of some of the other family and situational risk factors is warranted. Multiple developmental pathways to conduct problems are likely to exist (Nigg & Huang-Pollock, 2003), and hence no single risk factor will be equally important for all individuals. Worthy of note is the fact that there are several explanations for the causal role that these "risk factors" may play. Firstly they may simply act as a marker for conduct problems due to the shared association both the risk factor and the conduct problems have with a third causal factor. Secondly the risk factors may cause the conduct problems, either directly or indirectly via a mediating or moderating factor. Alternatively, the third explanation hypothesises that conduct problems directly or indirectly cause the risk factors. These and other potential explanations should be considered for each of the posited risk factors, but are discussed in more detail in relation to the role of verbal and non-verbal cognitive ability in section 1.6.1 (Goodman, Simonoff & Stevenson, 1995).

1.5.1 The role of parenting and family factors

Patterson's (1982) Coercion hypothesis is one of the most widely adhered to in the literature and indeed clinical practice with regard to understanding the potential underlying mechanisms behind conduct problems, as well as the implications for treatment. Patterson proposed that parents of children with conduct problems adopt a specific maladaptive parenting style in their interactions with their children. These "coercive" parents were described as inconsistent and overly harsh, focusing predominantly on negative behaviours whilst failing to acknowledge positive or pro-social behaviours, which was hypothesised to have the paradoxical effect of reinforcing the child's negative behaviour. Consequently, according to Patterson, a vicious circle ensues in which both parent and child persist in their maladaptive interaction. Many intervention strategies have been devised based on the underlying assumption that breaking the coercive interactional style will result in decreased disruptive behaviour in the child (e.g. Webster-Stratton, 1990).

The above account of the process by which coercive parenting exacerbates child behaviour problems might be placed within the "risk factor causes conduct problems" category of explanation. Nevertheless, other theorists have argued that parents' influence on children's behaviour takes the form of social learning, whereby children may witness antisocial behaviour in their parents and then internalise the same values and attitudes, leading to antisocial behaviour in the child (Farrington, 1995). Genetic heritability of course might offer an alternative explanation for the observed association between antisocial parents and children with enduring and serious antisocial behaviour, in that children inherit the same genes that could contribute to a propensity towards antisocial behaviour (Bohman, 1996; Simonoff, 2001). These accounts propose that a third factor (parent antisocial behaviour or genes) associated with both coercive parenting and child conduct problems, is responsible for the association between coercive parenting and child conduct problems. However, the alternative hypothesis ("conduct problems cause risk factors") is equally tenable. Children with conduct problems could conceivably be so difficult to manage that they lead parents to resort to coercive parenting strategies.

Parenting influences on conduct problems have also been explored in the form of impaired attachment styles (Shaw, Owens, Vondra, Keenan & Winslow, 1996), and exposure to abusive or neglectful experiences (Widom, 1989; 1997), which have also been shown to increase a child's risk for later maladjustment in the form of severe or persistent antisocial behaviour. Again, it is plausible to concede that children's early conduct problems might increase the likelihood that parents will form poor attachment relationships with them, or indeed that they will be subject to abusive or neglectful treatment. Assuming that experiences of abuse and neglect or poor early attachment relationships lead or predispose a child to antisocial behaviour rather than vice-versa, via what mechanisms might this occur? Batmanghelidjh (2004; personal communication, see www.kidsco.org.uk) argued from a purely anecdotal perspective that unprotected or abused children shut down emotionally as a way of protecting themselves from their traumatic experiences, but that as a result their "emotional numbness" might lead to an impaired capacity to empathise with others and thus no barriers exist to prevent them from inflicting harm on others. In extreme circumstances, some children might come to despise vulnerability, due to their shame at their own humiliation as victims of abuse. This could lead to crimes of hatred and violence against others perceived as vulnerable.

This hypothesis is consistent with Bowlby's (1944) theory pertaining to the importance of early attachment relationships for later social functioning and emotional regulation. The theory was based on Bowlby's observation that a sub-group of delinquent adolescents presented as emotionally detached, much like Batmanghelidjh's "emotionally numb" children, and a similar explanation for the origins of this state of detachment was put forward. In support of this theory, a number of studies have reported that a particular attachment style labelled "disorganised/disoriented attachment" or "D" characterise antisocial children. "D" refers to strange or inconsistent patterns of behaviour on behalf of the child when re-united with their caregiver after a period of separation, in which the child may alternate between attempts at contact with the caregiver and avoidance of contact, or show signs of fear. For example, Shaw, Owens, Vondra, Keenan and Winslow (1997) reported that children presenting with both disorganised attachment at 12 months and parental rating of difficult temperament at age 2 were in the 99^{th} percentile for aggression at age 5.

However, consistent and strong evidence for the causal effects of attachment to later conduct problems, independently of other family risk factors, has yet to be established in the literature (Hill, 2002). Moreover, the impact of extreme disruptions to the attachment process, by virtue of abuse and neglect, are difficult to define and study since they are often hidden (Knutson, DeGarmo & Reid, 2004). Thus it is likely that the most extreme forms of attachment disorder have rarely been studied, and therefore their impact may not be reflected in findings from research concerned with families consenting to research studies.

1.5.2 The role of poverty and social disadvantage

Yet further studies have suggested that poverty and social disadvantage are associated with enduring conduct problems (Farrington, 1993). Numerous theories have been proposed to account for the mechanisms by which the two factors are associated. It has been asserted that poverty and social disadvantage do not offer sufficient opportunities for the acquisition of social status, such that turning to antisocial means of gaining status is more likely (Cohen, 1956). Other researchers have argued that the causal effects of poverty and social disadvantage on conduct problems are not direct but are in fact mediated by family processes such as marital discord and parenting deficits (Maughan, 2001) which are likely to arise in situations of poverty and social disadvantage. Indeed, Sedlack and Broadhurst (1996) reported that children in households with an annual income of less than $15K were 16 times more likely to be physically abused than children in households with an annual income of more than $ 30K. Given that physical abuse has been shown to predict later aggression and antisocial behaviour (Knutson & Schartz, 1997), this is a possible mediator between poverty and antisocial behaviour.

The notion that antisocial behaviour can itself lead to poverty and social disadvantage is also tenable. Low academic attainment, poor social skills and difficulty in holding down a job are all factors contributing to the likelihood of being unemployed and on benefits, and are all associated with long-term antisocial behaviour (Rutter, Giller & Hagell, 1998).

Neighbourhood factors such as exposure to violence and crime have also been investigated, and found to be predictive of aggressive behaviour relatively independently of family and parenting characteristics (Gorman-Smith & Tolan, 1998). Nevertheless, it is still unclear whether the exposure per se is responsible for the observed aggression, or whether aggressive individuals seek out violent situations and are therefore more likely to be exposed to them (Hill, 2002).

One important criticism of all of the above studies is their consideration of environmental risk factors in isolation. It is more likely that environmental risk cuts across multiple domains of deprivation and disadvantage, which would be difficult to disentangle from one another given the co-occurrence of environmental risk factors (Richman, Stevenson & Graham, 1982). For example, a family living in extreme poverty would be likely to be exposed to crime, either as perpetrators as a means of obtaining money, or as victims by virtue of the neighbourhood in which they live. These conditions could occur as a result of, or could lead to, other problems such as mental health problems, marital conflict and stress. Thus it would be difficult to determine exactly what factors, if any in isolation, act as risk factors for antisocial behaviour. The common message arising from all of the above studies is the importance of considering a child's environment in any theory pertaining to the causal and maintaining factors underlying antisocial behaviour.

1.5.3 The role of genetics

It is well established in the literature that conduct problems show substantial heritability (e.g. Simonoff, Pickles, Meyer, Silberg & Maes, 1998). Nevertheless, exact heritability estimates relating to the proportion of variance in conduct problems explained by genetic contributions vary considerably depending on the informant of behaviour or the context in which the behaviour occurs (Simonoff et al, 1998). The extent to which genes and environment interact to predict behavioural outcome has thus been an important new aim for recent studies, determining the environmental conditions or stressors necessary for genetic propensities towards antisocial behaviour to be activated.

Bohman (1996), for example, conducted a study of Swedish adoptees. Findings indicted that adoptees with biological parents who were not antisocial and were reared in low-risk families had a 3% risk of adult criminality. The risk rose to 6% for those reared within a high-risk family. For adoptees with antisocial biological parents reared in low-risk families the risk of adult criminality was 12%, rising to 40% when reared in a high-risk family. According to Bohman's findings, genetic propensity towards antisocial behaviour contributes more strongly to behavioural outcome than environmental risk, with a low-risk environment offering some protection against criminal outcome, but still placing individuals at greater risk than having the environmental risk alone.

Caspi et al (2002) sought to investigate specific genetic and environmental interactions by investigating levels of monoamine oxidase A (MAOA) expression in the genotypes of children in the Dunedin Longitudinal Study. They found that amongst children who had experienced childhood maltreatment between the ages of 3 and 11 (in the form of sexual abuse, beatings or parental rejection), those with high levels of MAOA expression were less likely to go on to be antisocial in later life. In fact, maltreated children with low levels of MAOA expression were more than twice as likely to have been involved in antisocial behaviour by the age of 26 than maltreated children with high levels of expression. This antisocial group formed only 12% of the full sample, yet were responsible for 44% of all criminal convictions in the entire sample of 442 men. These findings address some of the questions raised around why some maltreated children go on to become antisocial whilst others do not (Widom, 1997), and offer support for the notion that environmental and genetic influences combine to produce risk for antisocial behaviour.

It is still unclear whether the genetic risk preceded the maltreatment or whether the maltreatment itself played a role in producing the genetic risk. Social experience has been demonstrated to alter molecular gene expression (Reiss & Neiderhiser, 2000), such that it would be plausible to assert that the traumatic experience of maltreatment could have altered the levels of MAOA expression. However, even by this account, the fact that some maltreated children but not others showed the genetic anomaly suggests that some genetic vulnerability must have preceded the traumatic events, even if it was not in the form of low levels of MAOA expression per se.

One further application of Caspi et al's findings relates to an account of the observed gender differences in antisocial behaviour. The MAOA gene is an X-linked gene, meaning that it is present on the X chromosome. Since males only have one X chromosome, it has been suggested that they would be more susceptible to disorders associated with deficits in X-linked genes. However, the MAOA polymorphism is now considered to be exposed to X inactivation in girls (Rutter, Caspi & Moffitt, 2003). This refers to a phenomenon whereby in order to counteract the differences in levels of X genes in males and females, one X chromosome is inactivated in females whilst the other remains active. Inactivation does not necessarily involve the same X chromosome in all cells, such that 10 to 15% of X-linked genes in females are expressed from the inactivated X chromosome (Willard, 2000). Inactivation is thought to be largely random, therefore the same proportion of girls and boys would be likely to present with the high-activity variant of the MAOA gene. This suggests that the findings with regard to the MAOA gene do not in fact offer a comprehensive explanation for the observed gender differences in antisocial behaviour (Rutter et al, 2003). The subject of gender differences in conduct problems will be returned to in more detail in section 1.9, but suffice to say at this point that the study of the shared effects of genetic and environmental factors has provided invaluable insight into the processes involved in the development and maintenance of conduct problems. It has paved the way for a more transactional approach to thinking about the risk factors associated with severe and enduring conduct problems, and a move away from considering individual risk factors in isolation.

1.6 Risk factors associated with persistent or severe forms of conduct problems: Child Risk factors

1.6.1 The role of non-verbal IQ and verbal ability

Consistent findings in the literature point towards a discrepancy in verbal and non-verbal cognitive ability of children with behaviour problems in comparison with control children (Goodman, Simonoff & Stevenson, 1995; Plomin, Price, Eley, Dale & Stevenson, 2002; Richman, Stevenson & Graham,1982; Sonuga-Barke, Lamparelli, Stevenson, Thompson & Henry, 1994). Moreover, poor cognitive ability has been proposed to differentiate persistent and severe offenders from those more likely to desist or partake in less serious offending (Moffitt, 1993).

Nevertheless, there is still considerable debate in the literature with regard to the causal direction of the associations. Goodman, Simonoff and Stevenson (1995) proposed four explanations for the observed association between low IQ and behavioural deviance. Firstly, they suggested that a *rater bias* might serve as a potential hypothesis. Children with a low IQ could also be expected to be from a low socio-economic status family, have parents with low IQs, and achieve poor academic attainment at school. All of the above factors could conceivably lead to teachers forming a negative view of the child and thus exaggerating their ratings of the child's behaviour accordingly. Likewise, one can also make a case for a rater bias on the part of parents with poor intellectual ability and low socio-economic status. It is not unlikely that such parents might be likely to report behavioural deviance from the point of view of the disproportional impact the child's behaviour might have on the parent given the context in which the behaviour is occurring.

The second proposed explanation for the observed association between low IQ and behaviour problems was the possibility that *low IQ is a cause* of behaviour problems. Goodman et al considered that a reduction in the child's self esteem as a result of poor academic attainment or frustration at the school or learning experience at which they may be struggling could account for the onset of behaviour problems as an outlet for their feelings of failure. On the other hand, the hypothesis that *low IQ is a consequence* of behaviour problems is equally plausible. Goodman et al discussed the potential for behaviour problems to interfere with learning and with performance on tasks measuring cognitive ability, such that low IQ could result from the behaviour problems rather than vice-versa.

Finally, Goodman et al presented their fourth hypothesis, that *low IQ is a marker* for behaviour problems. In this account, IQ itself is not viewed as a risk factor, but other factors related to both low IQ and behaviour problems are. From this proposal it is possible to speculate upon various environmental or biological factors linked to both IQ and behaviour, all of which could play a role in the dysregulation of cognition and behaviour. Low parental IQ, for example, may lead to inflexible, less responsive parenting, which in turn could create an environment in which behaviour problems are not managed and controlled, and cognitive development is not nurtured. Genes that affect both cognition and behaviour could be inherited and predispose some children to both low IQ and behaviour problems. Also plausible is the notion that impairments in cognitive functioning could be the result of brain damage or dysfunction that is also responsible for behavioural dysregulation.

Goodman, Simonoff and Stevenson (1995) set out to test their competing hypotheses. In this study they looked at IQ variations within the normal range in relation to behaviour problems in a sample of 13-year-old twins from inner-city London. The children's IQ was measured using the Wechsler Intelligence Scale for Children – Revised (WISC-R; Wechsler, 1974), using the full-scale IQ that combines verbal and non-verbal abilities. Parents and teachers rated child behaviour using the Rutter questionnaires (Rutter, 1967).

Findings revealed little evidence for the *rater-bias* account at least in the case of teachers. Social class was not a significant predictor of any teacher ratings, although it was for parent ratings. With regard to low parental IQ, there was no evidence that teachers differentiated between children of parents with low IQ or that parents with low IQ rated their children's behaviour differently.

The *IQ is a consequence* account was also unsupported by the findings. Goodman et al found a stronger association between conduct problems and low IQ than between hyperactivity and low IQ, and suggested that this would go against the prediction inherent in the theory. If behaviour problems disrupt learning and concentration to the point of interfering with performance on IQ tasks and learning in general, it would follow that hyperactivity should be more strongly associated with the resultant IQ scores than conduct problems, given the nature of the symptoms. That is to say, we might expect symptoms of overactivity, impulsivity and inattention to interfere with learning and performance to a greater degree than antisocial and disruptive behaviour.

Evidence was equally sparse in favour of the psychosocial accounts of the *IQ is a marker* hypothesis, although the biological accounts cannot be discounted. Once other variables had been covaried for, low parental IQ and socio-economic status were associated with fewer rather than more behaviour problems. However, the findings do not rule out the role of genetic predispositions or brain development abnormalities in the association between behaviour problems and low IQ.

The findings were therefore most strongly supportive of the *low IQ is a cause* hypothesis. The authors proposed that the most likely explanation to account for the association between behaviour problems and low IQ is that having a low IQ reduces children's self esteem and is frustrating for the child to the extent that their anger and sense of failure is expressed via disruptive or hyperactive behaviour.

Other researchers have described how the association could exacerbate behaviour problems. Both Farrington (1995) drawing on findings from the Cambridge Study in Delinquent Development, and Moffitt (1993) in her Dual Developmental Taxonomy noted that the most persistent offenders and often the most serious offenders were those whose antisocial behaviour had begun early in life and who had poor cognitive ability. Moffitt (1993) argued that having a low IQ presents fewer opportunities for desistence, and that the capacity to recognise and take advantage of such possibilities if they were to arise is limited. Thus, people with a higher IQ have a greater capacity to capitalise on alternatives to a criminal career. Having a low IQ therefore seems to contribute not only to the development of behaviour problems but also to their maintenance and severity.

However, there is some evidence that the positive association between cognitive ability and behavioural adjustment is to some degree culturally specific. Donnellan, Ge and Wenk (2000) found partial support for Moffitt's (1993) proposal that life-course persistent offenders would be more likely than adolescence-limited offenders to have a low IQ. They found that amongst their Californian sample of offenders, life course persistent offenders were indeed more likely to have a low IQ than adolescence-limited offenders, but only if they were of Caucasian or Hispanic ethnic origin. African American members of the sample were not less likely to desist from criminal activity if they had a high IQ. It was suggested that social sanctions in the form of employment or educational discrimination for ethnic minorities regardless of their IQ might render the theory inapplicable to this ethnic group. This study raised the importance of considering the context in which low IQ might be indicative of persistent antisocial behaviour, or moreover the context in which high IQ may protect against persistent or severe antisocial behaviour. Indeed, the legitimacy with which the low IQ-behaviour problems hypothesis can be applied across different ethnic groups is an area of contention, given that historically variations in IQ according to race have been reported and have been difficult to interpret, fuelling speculation over whether different constructs of intelligence should be considered for different ethnic groups (Prinz & Miller, 1991). Nevertheless, other studies which have included and contrasted individuals from different racial-ethnic groups, such as the Pittsburgh Youth Study (Loeber, Farrington, Stouthamer-Loeber & Van Welmoet Kammen, 1998), have found that the association between IQ and behaviour problems is independent of race and ethnic origin.

There are some other caveats in the theory that have sparked some debate in the literature. The extent to which hyperactivity and conduct problems can be disentangled to determine the relative strengths of associations of poor cognitive ability and conduct problems has been largely ignored until relatively recently, perhaps due to the difficulties associated with separating out symptoms of two highly co-morbid behaviour problems (McGuire & Richman, 1986). Is it the case that only hyperactivity is associated with cognitive impairment, whilst conduct problems appear to be by virtue of their frequent co-morbidity with hyperactivity? Hinshaw (1992) believed this to be the case. He considered hyperactivity occurring alongside cognitive impairment to be a syndrome with neuro-developmental origins, and argued that the fact that hyperactivity seems to be associated with cognitive impairment earlier in development than conduct problems suggested that a different developmental process accounted for the association between cognitive impairment and conduct problems. He argued that the association has socio-environmental origins in conduct problems, related to social disadvantage and family discord, which would not manifest itself until later in development. Hence Hinshaw would consider that any association found between conduct problems and cognitive impairment in early development would be due to co-morbid hyperactivity. A similarity can be drawn between Hinshaw's hypotheses and Goodman et al's *IQ is a marker* hypothesis, with hyperactivity sharing neuro-developmental causes with cognitive impairment, and conduct problems sharing socio-environmental causes with cognitive impairment.

Drawing on Hinshaw's hypothesis, Sonuga-Barke, Lamparelli, Stevenson, Thompson and Henry (1994) conducted a study of preschool children selected for the presence or absence of conduct problems or hyperactivity. They predicted that hyperactivity but not conduct problems would be associated with intellectual performance. The findings offered support for Hinshaw's account. The presence of hyperactivity but not conduct problems predicted low general intelligence. This finding is inconsistent with the findings from Goodman et al's (1995) study in which a stronger association was found between conduct problems and low IQ than between hyperactivity and low IQ. The fact that the children in Goodman et al's sample were older than in Sonuga-Barke et al's (1994) sample (13 years old versus preschoolers) might suggest that there is a developmental shift in the associations over time.

However, before it can be determined whether conduct problems and hyperactivity might be differentially associated with cognitive impairment, another point of contention in the literature needs to be addressed: the role of verbal versus non-verbal cognitive ability. Research has begun to separate verbal and non-verbal cognitive ability in order to decipher which specific type of cognitive deficit is more strongly linked to behavioural maladjustment. All of the studies described above differ in the measure of intellectual ability they have used. Goodman et al (1995) for example used the WISC-R (Weschler, 1974) full-scale IQ score, which combines both verbal and non-verbal cognitive abilities and hence tells us nothing about the relative contribution of each of them to the association between behaviour problems and cognitive functioning. Similarly, Sonuga-Barke et al (1994) used the McCarthy full-scale IQ score (McCarthy, 1972) that combines verbal and non-verbal ability.

The consensus from studies which have focused on conduct problems specifically and separated non-verbal and verbal ability, is that deficits in verbal, but not non-verbal intelligence predict conduct problems (Brennan, Hall, Bor, Najman & Williams, 2003; Elkins, Iocono, Doyle & McGue, 1997; Frost, Moffitt & McGee, 1989; Henry, Moffitt & Silva, 1992; White, McCarthy & Fantino, 1989). Moffitt (1990), for example, found that in the Dunedin Longitudinal Study, age 5 verbal IQ contributed an additional 6% of the variance in age 11 antisocial behaviour, over and above that explained by age 5 antisocial behaviour. In contrast, the profile of cognitive impairment associated with hyperactivity and ADHD is more pervasive, including deficits in both non-verbal and verbal cognitive ability (e.g. Tripp, Ryan & Peace, 2002). This might account for the findings reported by Sonuga-Barke et al (1994) that hyperactivity, but not conduct problems, predicted low general intelligence. It is likely that the pervasive pattern of impairment in the hyperactive children contributed to the significantly poorer general IQ, whereas had the separate aspects of IQ been investigated it may have emerged that conduct problems would predict poor verbal, but not non-verbal ability.

Support for this contention can be drawn from a more recent study. Donnellan et al (2000) used a variety of measures of cognitive ability, the California Achievement Test (CAT, Tiegs & Clark, 1951) that assesses academic attainment, the California Test of Mental Maturity (CTMM, Sullivan, Clark & Tiegs, 1963) which combines verbal and non-verbal cognitive tasks, and the General Aptitude Test Battery (Anastasi, 1976), again a measure of both verbal and non-verbal ability. No test of purely verbal ability was administered, however the Raven Test of Progressive Matrices (Raven, 1960) was used and is a non-verbal task. No differences were found between the life course persistent offenders and the adolescence-limited offenders with regard to the purely non-verbal measure, whereas the adolescence-limited group demonstrated superior performance on the other measures in comparison with the life-course persistent group. The findings therefore suggest that verbal ability in the tasks which measured both verbal and non-verbal ability may have been the most important factor in the observed associations between performance on the tasks and group membership (life course persistent versus adolescence limited).

Much of the above literature, however, is based on older samples of children with established antisocial behaviour. It is important to determine developmentally how early the associations between conduct problems and verbal ability might emerge, in order to help ascertain the potential causal mechanisms of verbal ability to the aetiology of conduct problems. If such an association is not apparent amongst very young children this might be indicative of a causal role of conduct problems in the development of verbal skills, rather than vice-versa. Richman, Stevenson and Graham's (1982) Waltham Forest Study measured aspects of social and cognitive functioning in a group of 200 children, made up of children identified as having early problem behaviour and control children with no behaviour problems. Children were rated by parents on the Behavioural Screening Questionnaire (BSQ, Richman & Graham, 1971) to determine the presence or absence of behaviour problems. The BSQ did not distinguish between hyperactivity and conduct problems, however the study had the advantage of focusing on a very young cohort. The children were assessed at 3 years old and followed up 1 year and 4 years later. At age 3 measures of cognitive functioning included: the English Picture Vocabulary Test (EPVT, Brimer, 1962), a measure of verbal comprehension; and the Griffiths scale D and E (Griffiths, 1970) which measure hand-eye co-ordination and perceptual motor abilities (both non-verbal measures).

Findings indicated that at age 3 the "problem behaviour" group performed significantly worse at verbal comprehension and hand-eye co-ordination but not perceptual motor ability. In terms of extreme scores below set cut-off points on the cognitive measures, a significantly greater proportion of children in the problem behaviour group had mild specific language delay compared with controls. No difference in the proportion of "problem behaviour" children with low non-verbal IQ was found. These findings suggest that in the general population both verbal and non-verbal ability are associated with behaviour problems. However, amongst a sub-group of children with severe cognitive deficits, verbal deficits appear to be more strongly associated with behaviour problems than non-verbal deficits. This finding is consistent with Donnellan et al's (2000) conclusions.

When the children in the Waltham Forest Study were 4 years old the Weschler Pre-school and Primary Scale of Intelligence (WPPSI, Weschler, 1967) was also administered. This scale yielded scores for verbal, performance (i.e. non-verbal) and full-scale IQ. The problem behaviour group performed significantly worse on the verbal and performance scales of the WPPSI compared with controls. With regard to the extremes analyses (none of which included a group below a cut-off on a purely non-verbal measure), a greater proportion of children with mild and severe general language delay and low full-scale IQ were in the problem behaviour group. Thus, both verbal and non-verbal ability appeared to be associated with problem behaviour at age 4. This may of course be due to a surge in hyperactive behaviour at this age, which might have produced this more pervasive profile of cognitive impairment.

To try and address the gap in the literature relating to studies which differentiate between verbal and non-verbal cognitive ability in very young children, Plomin, Price, Eley, Dale and Stevenson (2002) reported further findings from the TEDS community study. In this set of analyses the authors looked at extreme groups (with regard to cognitive ability rather than behavioural extremes) as well as whole sample effects, verbal as well as non-verbal ability, and 2, 3 and 4 year old children. Behavioural measures consisted of a range of parent-rated instruments, and behaviour was analysed using total scores, hence no distinction was made between symptoms of hyperactivity and symptoms of conduct problems. The MacArthur Communicative Development Inventory (MCDI; Dale, Reznick & Thal, 1998) was used as a measure of verbal development, derived from parent ratings of their child's vocabulary. The Parent Report of Children's Abilities (PARCA; Saudino et al, 1998) was used as the measure of non-verbal development. The PARCA was a scale developed by the authors, including parent-rated and parent-administered subtests. Modest associations were found between behaviour problems and verbal and non-verbal ability across the age groups and for both extreme and whole-group analyses, with the strength of associations increasing linearly with age. Non-verbal ability showed a significantly greater association with behaviour problems than verbal ability, a finding that is inconsistent with Donnellan et al's (2000) findings. This could potentially be due to the fact that in Donnellan et al's study the behavioural measure was concerned with anti-social behaviour (adolescence-limited versus life-course persistent offending), whereas Plomin et al (2002) conducted checklists on a community sample of children who were much younger than in Donnellan et al's study, which combined features of both conduct problems and hyperactivity. This would suggest that hyperactivity is predominantly associated with non-verbal ability, rather than equally associated with both as in previous studies (Tripp et al, 2002). Alternatively, younger children's behaviour may be more influenced by variations in non-verbal ability but as they grow older verbal ability begins to associate more strongly with behavioural adjustment. Both of these speculations are tenable accounts based on the inconsistent findings, but clearly further studies in this area will be necessary to help clarify the nature of the associations between behaviour and cognitive ability, particularly in very young children.

If we do adhere to the theory that verbal ability is specifically associated with conduct problems, via what mechanism might verbal ability mediate risk for conduct problems, or vice versa? Rutter (2003) speculated that that poor verbal ability itself might constitute risk, or alternatively that it may be an index of a broader form of neuro-developmental impairment. In terms of determining the direction of causation, this might depend upon the account of association which is adhered to. If poor verbal ability contributes to the onset and maintenance of behaviour problems, as in the "IQ is a cause" theory, having poor verbal ability could interfere with the ability to communicate effectively which might be more likely to lead to conduct problems due to the frustrations caused by communication problems. Other theorists have attested to the notion that internal self-talk is an integral part of behavioural regulation (Luria, Yudovich & Kovasc, 1971), and thus a deficit in verbal ability could compromise one's ability to regulate behaviour. By this account however, it is difficult to determine why the association would be particularly applicable to conduct problems, given that poor behavioural regulation is perhaps a more accurate description of hyperactivity. On a similar vein, if one considered the "IQ is a consequence" theory that conduct problems could cause deficits in verbal ability, one might presume either that the behaviour interferes with the acquisition of verbal ability, or disrupts performance on tasks measuring verbal ability. Again, by this account one might predict that the theory would be better applied to hyperactivity with its associated attention deficit, since this might be more likely to interfere with task performance than conduct problems. Further, why behaviour should specifically interfere with the acquisition of verbal ability or performance on tasks measuring verbal ability is not clear by this account. In order to more carefully formulate such theories, more studies separating out verbal and non-verbal cognitive ability and CD and AD/HD symptoms are necessary.

In summary, it is well established that cognitive impairments are associated with behaviour problems, and in particular behaviour problems that are severe and enduring (Farrington, 1995; Moffitt, 1993). The consensus appears to be that with regard to conduct problems, deficits in verbal ability rather than non-verbal ability are risk factors for later continuity of problems (e.g. Elkins et al, 1997; Moffitt, 1990), in that they are deemed to be characteristic of the early-onset persistent sub-group of delinquents, whose antisocial behaviour is more severe and enduring (Moffitt, 1993). However, further studies of pre-school children which distinguish conduct problems from hyperactivity and verbal from non-verbal ability are necessary to confirm whether a negative association between conduct problems and verbal ability is in fact evident at such a young age, and thus help determine the developmental course and causal mechanisms of associations between verbal ability and conduct problems.

1.6.2 The role of theory of mind

Another area of functioning to be considered, which has received little attention in the study of conduct problems, is the concept of "theory of mind" competency. Theory of mind refers to the ability to attribute mental states to others in order to predict and explain the thoughts, feelings or actions of others, and is a process that is believed to undergo a significant period of development during the pre-school years (Flavell, 1999; Wimmer & Perner, 1983).

Hughes, Dunn and White (1998) examined theory of mind competency in a sample of "hard-to-manage" four-year-olds and compared their performance with a group of control children without behaviour problems. Tasks measuring theory of mind competency included "false belief" tasks assessing the child's ability to predict a character's actions based on their (false) belief of reality, and an emotion understanding task in which children were asked to predict how a character would feel based on whether they received a "nice" or "nasty" surprise.

Findings indicated that the hard to manage children were delayed in their understanding of mind compared with the control children as measured by standard false belief tasks. Moreover, the hard to manage children displayed a bias in terms of a more accurate understanding of stories entailing a "nasty" surprise than a story involving a "nice" surprise. Previous research had indicated that in normative development, the understanding of a "nice" surprise develops before the understanding of a "nasty" surprise (Wellman & Banerjee, 1991). Thus, pre-school disruptive children appeared to be showing delayed and deviant development relative to their peers in terms of theory of mind understanding (Hughes et al, 1998). Nevertheless, as the authors pointed out, it is possible that the observed difference between the hard to manage group and the control group on the "nice" versus "nasty" surprise task might simply reflect the differences in the social environments of the two groups of children. It may be that the social interactions of hard to manage children entail a greater degree of hostility, leading to the enhanced accuracy in the recognition of negative social situations relative to positive social situations.

Assuming that the association between behaviour problems and theory of mind development is replicable, what might be the reason for this? Might having an impaired theory of mind lead to disruptive behaviour or vice-versa? Or, as discussed at the beginning of this section with regard to the association between cognitive functioning and behaviour problems, could theory of mind be a marker for behaviour problems due to a third factor associated with both theory of mind development and behavioural regulation? Further research will be necessary to answer this question in relation to theory of mind development, which has only recently been linked with behaviour problems (Hughes et al, 1998). One might postulate that having an impaired understanding of other people's intentions or mental states might lead children to misread social situations and therefore be more likely to engage in aggressive or disruptive behaviour. This is exactly the process put forward by Dodge (1980) to account for the peer problems experienced by children with conduct problems. Dodge proposed that children with conduct problems misattribute hostile intent in others and are therefore more likely than their peers to respond in an unnecessarily aggressive or hostile manner. This notion is also comparable with Happé and Frith's (1996) assertion that children with conduct problems develop a theory of "nasty" minds.

On the other hand it is equally compelling to adhere to the theory that disruptive behaviour leads to peer rejection, which minimises opportunities to develop social understanding in a normal social context, and consequently theory of mind understanding is delayed or deviant. One might also argue that other environmental influences such as negative family environment or coercive parenting practices (Patterson, 1982) could lead to both conduct problems and a skewed idea of intent or a theory of "nasty" minds (Happé & Frith, 1996).

Whatever the underlying mechanisms behind the association, there is sufficient cause for concern about children presenting with both early conduct problems and a delay or impairment in theory of mind understanding. It is well established that impaired social functioning in later childhood is associated with behaviour problems, and that this can predict a host of negative consequences, including academic failure, delinquency, alcohol and drug abuse, mental health problems and criminal activity (Parker & Asher, 1987). Children's competency in theory of mind development is positively associated with active engagement in pretend play (Taylor & Carlson, 1997), school adjustment (Dunn, 1995), positive mother-child interactional styles (Ruffman, Perner & Parkin, 1999) and peer acceptance (Slaughter, Dennis & Pritchard, 2002). It follows therefore that a delayed or deviant theory of mind understanding could lead to a variety of problems in social functioning. It seems a logical rationale on which to base the hypothesis that a deficit or delay in theory of mind development would be predictive of a particularly poor outcome in children with early conduct problems, given the additional difficulties that such a deficit is likely to contribute. However, one study provides evidence against the theory presented above that a deficit in theory of mind competency is associated with conduct problems. Sutton, Smith and Swettenham (1999) found that bullies, notorious for antisocial behaviour, presented with an enhanced theory of mind relative to children not engaging in bullying and antisocial behaviour. They suggested that in some cases, children with an advanced understanding of others' minds who have the inclination to be antisocial could in fact utilise their mind-reading skills in order to further their antisocial behaviour. Thus, understanding and predicting how another might feel in response to an aggressive or hurtful act could, contrary to the theories presented above, increase the likelihood that the individual will engage in the antisocial behaviour.

1.6.3 The role of inhibitory control

Deficits in executive functioning have also been associated with conduct problems. Executive functioning is a blanket term used to describe a constellation of processes underlying goal-directed behaviour, encompassing planning, inhibitory control, attentional flexibility and working memory (Duncan, 1986). The frontal lobe region of the brain is the area most commonly associated with executive functioning (Duncan, 2001). Until recently, studies of deficits in executive functioning had primarily focused on children with autism and ADHD (see Barkley, 1997; Ozonoff, 1997). However, several researchers have since claimed that impairments in frontal lobe functions might characterise individuals with particularly extreme forms of antisocial behaviour (Lynam, 1996; Moffitt, 1993). Indeed, a review of brain imaging studies concluded that violent and psychopathic offenders have impairments in the frontal region of the brain (Henry & Moffitt, 1997).

In line with the above, Lynam (1996), argued that children displaying early signs of psychopathic-like antisocial behaviour can be distinguished from other children in that they are unable to inhibit a dominant response or goal-directed behaviour when they are faced with cues from the environment that the response should be modified. This description fits the definition of inhibitory control, an executive function responsible for the suppression of a pre-potent response in order to prevent its interfering with the execution of a conflicting or alternative action.

More recently, impairments in inhibitory control have been found in "hard to manage" preschoolers (Hughes, Dunn & White, 1998), suggesting that such deficits might be detectable at a very early age. The study found that alongside the differences in theory of mind ability discussed in the previous section, the hard to manage group were also significantly impaired on four tasks measuring executive function relative to the control group. Two of the four tasks specifically measured inhibitory control: the detour-reaching task (Hughes & Russell, 1993), involving the child switching between different methods of retrieving a marble depending on the colour of light illuminated, and Luria's hand game (adapted by Hughes, 1996) whereby children were required to produce the opposite hand shape to the experimenter following a habituation trial in which the child was taught to respond with the same hand shape. Both tasks placed demands on the child's capacity to inhibit a pre-potent or dominant response in order to carry out the desired action.

"Hard to manage" children were less likely to pass these tasks than the control children, and with regard to the detour reaching task specifically, group membership was still predictive of performance on the task even when child vocabulary, fathers' occupational status and mothers' educational level had been covaried for in the analyses. This suggests that, for the detour-reaching task at least, the findings were robust. Not only did the groups differ, but the differences could not be attributed to the shared variance with vocabulary and parental socio-economic status.

Nevertheless, executive impairments, in particular inhibitory control, have long been associated with ADHD, notably Barkley's (1997) inhibition hypothesis. Thus, Hill (2002) suggested that due to the high degree of co-morbidity between conduct problems and ADHD, the impairments in inhibitory control found in children with conduct problems might in fact be attributable to ADHD. Indeed, Hughes' hard to manage sample were selected for the presence of hyperactivity, and whilst 80% of the children also scored above the 90th percentile for conduct problems, the possibility that the findings reflected deficits underlying the hyperactivity rather than the conduct problems cannot be overlooked. Hill also presented a number of other reasons for a cautious interpretation of the observed link between executive deficits and conduct problems. He noted that executive abilities show some degree of overlap with other areas of functioning such as memory and IQ, and urged that these functions should be controlled for before inferring a direct link between inhibitory control and conduct problems. In addition, Hill argued that motivational factors might impede children's performance on tasks measuring functions such as inhibitory control, particularly given that most studies have involved older children or adolescents with established conduct problems.

Adhering to the notion that there is a link between conduct problems and inhibitory control, what might be the causal direction and mechanisms underlying the relationship? Many theorists (e.g. Gorenstein, 1982; Yeudall, 1980) have suggested that executive deficits such as inhibitory control may lead to an inability to consider the consequences of one's actions. This would implicate inhibitory control deficits in the development of conduct problems. Consistent with this notion, Raine (2002) presented the "prefrontal dysfunction theory of antisocial and aggressive behaviour" to account for the association. Raine used Moffitt's (1993) observation that antisocial behaviour peaks at adolescence to illustrate his theory. Raine argued that the social demands of adolescence place a great demand on the frontal cortex and executive functions, at a time when the frontal cortex is still maturing. Suddenly numerous aspects of executive functioning are required to cope with the changing social pressures of adolescence, for example planning and developing strategies for attracting a partner or getting a job, or inhibiting antisocial responses to threats and challenges to social status inherent in peer group relationships.

Raine pointed out that the maturation of the frontal cortex in early adulthood corresponds with the decrease in antisocial behaviour seen at this time period (on the part of the adolescence-limited individuals at least), offering support for his theory. He suggested that individuals who continue in their antisocial behaviour beyond the adolescent period have a deficit or delay in the frontal region of the brain which does not become fully functional in early adulthood and thus does not offer opportunities to desist from the behaviour.

The interaction between biological and social factors in the development of antisocial behaviour was also implicated in Raine's theory. It was possible, according to Raine, for a person with frontal dysfunction to be protected from antisocial behaviour by virtue of a particularly supportive or undemanding social environment. This aspect of the theory also answers the critics who would argue that not all individuals with frontal impairments engage in antisocial behaviour. Thus, a complex interplay between biological, social and environmental factors seems likely to be involved in the development of antisocial behaviour.

Within the complex interplay of factors, inhibitory control appears to play a key role in the development of antisocial behaviour. Deficits in inhibitory control and other executive functions controlled by the frontal region of the brain are associated with particularly severe and enduring forms of antisocial behaviour such as psychopathy and violent offending. It would follow that the co-occurrence of both early emerging conduct problems and inhibitory control deficits might constitute a poor prognosis for the future.

1.6.4 The role of social skills

It has been reported that conduct problems are often accompanied by social problems (Parker & Asher, 1987). Many interventions for conduct disorder are therefore based upon improving children's social skills in order to improve their behaviour (e.g. Kazdin, Esveldt-Dawson, French and Unis' (1987) Problem Solving Skills Training; Webster-Stratton's (1991) Incredible Early Years Dinosaur Social Skills and Problem-Solving Curriculum). Such interventions may operate under the underlying hypothesis that social skills deficits cause conduct problems. In Stevenson and Goodman's (2001) study tracing the adult criminal convictions of children from the Waltham Forest Study (Richman et al, 1982), one of the aspects of child functioning at 3 years which emerged as a significant independent predictor of adult convictions (including violent convictions specifically) was social competence. Being poor at relating to others thus seems to be a risk factor for particularly persistent and severe antisocial behaviour later in life.

In what ways might social skills deficits lead to or exacerbate conduct problems, or vice-versa? Having poor social skills might not bode well for peer acceptance, and given that peer acceptance has been identified as a moderating factor in the relationship between family adversity and child externalising behaviour (Criss, Pettit, Bates, Dodge & Lapp, 2002), peer rejection represents a serious threat to a child's prognosis. This process leading from peer rejection as a result of poor social skills to conduct problems could operate via a lack of opportunities for positive socialisation and social support which leads to maladjusted outcome (Parker & Asher, 1987) or a consequent association with a deviant peer group and socialisation into deviant behaviour such as conduct problems (Elliott, Huizinga & Ageton, 1985; Farrington et al, 1990).

From the opposite perspective, Coie, Coppotelli and Dodge (1982) proposed that aggression is the single most important factor associated with peer rejection. Indeed, it has been asserted that children with conduct problems are often rejected by their peer group (Wood, Cowan & Baker, 2002). This process might therefore underlie the association between social skills deficits and conduct problems. Conduct problems may lead to peer rejection due to the unappealing nature of a child who is aggressive towards their peers, and the consequent isolation and lack of opportunities to engage in positive social interactions may limit the extent to which social skills are developed and fostered.

Thus far, peer rejection has emerged as a potential mediator between the relationship between conduct problems and poor social skills. However, other theories have not implicated peer rejection as a necessary contributing factor. For example, children with conduct problems have been observed to display biases in information processing in social situations leading to the misattribution of hostile intent on the part of others, and hence a predisposition towards reacting aggressively (Dodge, Price, Bachorowski & Newman, 1990; Dodge & Somberg, 1987), and this has been hypothesised as one of the underlying causes of the social problems experienced by children with conduct problems. If a child is consistently attributing hostile intent on the part of the person they are interacting with, this might have a negative impact on the child's willingness to utilise or ability to learn appropriate social skills.

Weiss, Dodge, Bates and Petit (1992) suggested that the social maladjustment seen in conduct disorder is the result of an interaction between a genetic vulnerability for cognitive processing deficits and a maladaptive social learning environment. This corresponds well with Caspi et al's (2002) findings relating to the interaction between genetic susceptibility and child maltreatment to produce an increased likelihood of conduct problems. Thus it seems that the association between conduct problems and poor social skills is likely to result from a complex interplay between a number of social and biological factors. Whatever the underlying mechanism, it is clear that conduct problems alongside social skills deficits constitute a potentially poor prognosis for the long-term outcome of conduct problems.

1.6.5 The role of hyperactivity

Several factors warrant consideration with regard to hyperactivity. Firstly, the issue of co-morbidity between conduct problems and hyperactivity in terms of the greater risk associated with this profile of behaviour than conduct problems or hyperactivity alone (e.g. Faraone, Biederman, Jetton & Tsuang, 1997). This issue shall be explored in this section, since it relates to the increased risk engendered by the presence of hyperactivity alongside conduct problems.

Also important to consider is the extent to which deficits associated with hyperactivity, given its high co-morbidity with conduct problems (Angold, Costello & Erkanli, 1999), might in fact be responsible for the observed deficits found to be associated with conduct problems. Thus, is it the case that all of the risk factors considered above are in fact only associated with severe and enduring conduct problems by virtue of concurrent high levels of hyperactivity which tend to go alongside severe conduct problems? This subject has been touched upon briefly with regard to IQ, but shall be explored in more detail in section 1.7 below. Finally, given the co-occurrence of hyperactivity with conduct problems and our interest in whether the two aspects of behaviour are truly separable, a brief review of some of the current theories of the aetiology and maintenance of hyperactivity is also presented in section 1.7. Bearing in mind that conceptualising co-morbid hyperactivity as a risk factor for severe and enduring conduct problems raises these additional issues, to be discussed in section 1.7, we return to the current section and the notion that early conduct problems accompanied by hyperactivity could constitute risk for poor outcome.

Conduct disorder is commonly associated with other psychiatric disorders, particularly ADHD, depression and anxiety (Angold, Costello & Erkanli, 1999). The term "co-morbidity" is often used to refer to co-occurring symptoms of distinct disorders, and the odds ratio for ADHD in the presence of conduct disorder has been estimated at 10:7. The co-morbidity between the disorders could arise from symptom overlap, for example physical aggression towards others might be attributed to the impulsivity of AD/HD in response to physical aggression, in other words an inability to inhibit the impulse to hit back, or might be considered to reflect the violation of social norms and defiance characterised by CD. That is to say, due to the high degree of symptom overlap, the two disorders might be difficult to disentangle in the first place, such that it is difficult to determine what the "true" co-morbidity of the two disorders may be.

Research has consistently shown that children displaying symptoms of both ADHD and conduct disorder fare worse than children with only symptoms of conduct disorder, in that their antisocial behaviour is more varied, severe and enduring. Children presenting with co-morbid hyperactivity and conduct problems tend to have parents with higher rates of antisocial behaviour disorders and substance abuse than parents of children with "pure" ADHD (Faraone, Biederman, Jetton & Tsuang, 1997; Faraone, Biederman, Keenan & Tsuang, 1991), and are more likely to engage in criminal activity as adults than children with either symptom profile alone (Babinski et al, 1999). Moffitt (1990) followed up a group of 453 boys from the age of 3 to 15 years, and explored the developmental trajectories of 4 sub-groups defined at age 13: children who showed delinquent and antisocial behaviour only, children with both hyperactivity and delinquent/ antisocial behaviour, children with hyperactivity only, and finally a group of comparison children with no symptoms of behavioural dysfunction. At age 13 the co-morbid group presented with significantly poorer scores on scales measuring IQ, reading achievement, verbal ability and memory than the other sub-groups, and between the ages of 5 and 13 the co-morbid group were consistently more antisocial than the other sub-groups at every age. Further, at age 15 the co-morbid group scored significantly higher on self-reported aggression, and higher (though not significantly so) on self-reported theft and vandalism.

Lynam (1996) even labelled children with such a co-morbid profile of symptoms "fledgling psychopaths", reflecting a qualitatively distinct group from those with ADHD or conduct symptoms alone. This early presentation of behaviour according to Lynam's (1996) theory, is an early indicator of later psychopathy, which is a personality profile characteristic of many violent offenders (Hare, 1981). Children presenting with hyperactivity and conduct problems are hypothesised to present with a number of neuropsychological impairments characteristic of adult psychopaths. For example, Gorenstein (1982) proposed that psychopathic individuals have frontal lobe impairments resulting in impaired performance on tasks measuring executive functions. Lynam (1996) drew attention to Moffitt and Henry's (1989) study to illustrate that a similar profile of impairment is evident amongst children with conduct problems and hyperactivity. This study examined children with hyperactivity and conduct problems, hyperactivity only and conduct problems only, and reported that deficits in executive function (measured by the Wisconsin Card Sort Test, Rey Auditory Verbal Learning Test, WISC-R Mazes, Trail-Making Test B and the Rey-Osterreith Complex-Figure Test) were specific to the co-morbid group. If Lynam's theory is accurate, this group of individuals in early childhood are of particular concern for the future.

It is still unclear whether having both types of problems constitutes a poorer prognosis due to the sheer number of symptoms, or whether the particular combination reflects a distinct disorder (Hill, 2002). Yet others have claimed that the two disorders are in fact two points in the same developmental process, with hyperactivity preceding and developing into a more antisocial profile of behaviour leading eventually to early-onset delinqueny (Patterson, DeGarmo & Knutson, 2000). Taylor, Chadwick, Heptinstall and Danckearts (1996) gained parent and teacher ratings of children's behaviour using the Rutter scales when the children were 6 and 7 years old. They were then followed up at 17 and 18 years of age. Hyperactivity in childhood was found to predict conduct problems in adulthood, whereas the opposite was not true: conduct problems in childhood did not predict hyperactivity in adulthood. Taylor et al conceptualised the findings as reflecting that conduct disorder is a complication of hyperactivity, rather than an early stage of a single disorder. Yet other theorists have proposed that since children with hyperactivity only, but not those with both hyperactivity and conduct problems, present with deficits in sustained attention (Chee, Logan, Schachar, Lindsay & Wachsmuth, 1989) and other specific deficits such as visual search task accuracy (Leung & Connolly, 1994), the presentation of conduct problems and hyperactivity may in fact be something more than merely hyperactivity which then develops into conduct disorder (Schachar & Logan, 1990).

The reason for the co-morbidity aside, it is clear that children presenting with a profile of symptoms reflecting both hyperactivity and conduct problems are at increased risk for continued problems later in development. Being impulsive, inattentive, hyperactive and aggressive constitutes a particularly dangerous combination of symptoms in terms of long-term outcome. This presentation of symptoms should thus be a focus for research aiming to understand more about the precursors of later serious antisocial behaviour.

1.6.6 Risk factors: Summary

A range of child risk factors have been reviewed, all of which have been hypothesised to predict persistent conduct problems. As discussed in section 1.4, multiple pathways to persistent conduct problems are likely to exist (Nigg & Huang-Pollack, 2003), and the relative importance of these risk factors is likely to depend upon a number of variables, including the environmental context in which the early conduct problems are being displayed. Children presenting with a given combination of risk factors alongside conduct problems may only be likely to continue to engage in antisocial behaviour in the context of an adverse, or "criminogenic" environment (Moffitt, 1993). Nevertheless, it is important to determine the extent to which the child risk factors can predict continuity of problems in a sample so young, and therefore the extent to which the following hypothesis can be supported:

"Overall, the children at highest risk for early-onset persistent offending are those with both early attentional and externalizing behavior problems (diagnostically, those with conduct disorder plus ADHD), who experience a cluster of cognitive vulnerabilities related to both executive and verbal cognitive skills. These weaknesses are apparent by pre-school." (Nigg & Huang-Pollock, 2003).

1.7 Comorbidity between conduct problems and hyperactivity: A confounding factor?

As mentioned in the section above, one potentially confounding factor in considering the possible risk factors for the likelihood that early-onset conduct problems will persist or worsen, is the issue of co-morbidity between conduct problems and hyperactivity. A strong debate in the literature therefore surrounds the possibility that the cognitive and executive deficits reportedly associated with severe and enduring conduct problems or indeed the "conduct problems + hyperactivity" profile, might in fact exist purely by virtue of the co-existing hyperactivity (Hill, 2002).

Studies in the literature which have controlled for the possible confounding factor of co-morbid hyperactivity have reported conflicting findings. Séguin, Boulerice, Harden, Tremblay and Pihl (1999), for example, reported that two distinct executive tasks associated with activity in different regions of the brain ("conditional association" and "subjective ordering") differentiated between different types of aggressive behaviour (stable and unstable), whereas ADHD was not associated with either executive ability. This finding is consistent with the notion that conduct problems may be associated with cognitive or neuropsychological impairments, which are independent of the association with hyperactivity. In contrast, Berlin and Bohlin (2002) used the go/no go task and a stroop task to measure response inhibition in a non-clinical sample of pre-schoolers. They found that response inhibition was associated with both hyperactivity and conduct problems. However, the association between conduct problems and inhibition was no longer significant when controlling for hyperactivity, whereas the association between hyperactivity and inhibition was still significant when conduct problems were controlled for. This study suggests that the association between conduct problems and inhibition was accounted for by hyperactivity, and that when this was removed from the equation, the association was no longer present.

It is clear therefore that studies concerned with the cognitive correlates of or causal mechanisms of conduct problems should control for the influence of co-morbid hyperactivity. This will enable a greater understanding of the extent to which conduct problems and hyperactivity are truly separable constructs, and will help determine which aspects of cognitive functioning might be specifically linked to one or other aspect of behaviour. It is of interest which aspects of functioning, if any, might differentiate conduct problems and hyperactivity. For example, hyperactivity, though closely associated with conduct problems and highly co-morbid, has been proposed to be associated with a more pervasive profile of cognitive impairment than that of conduct problems. This contention is to some degree corroborated by genetic studies in which the two behavioural profiles have emerged as differentially associated with genetic influences.

Rutter, Silberg, O'Connor and Simonoff (1999), for example, in their review of quantitative molecular genetic research in psychiatric disorders, concluded that a relatively strong genetic component was associated with ADHD, which was suggestive of a key role for genes controlling neurotransmitter function. Also consistent with this notion is the reported finding that the association between ADHD and low IQ has genetic origins (Kuntsi et al, 2004). Rutter et al (1999) reported that antisocial behaviour on the other hand (incorporating adult antisocial behaviour and childhood forms of ODD and CD), showed a distinctive pattern with regard to the suggested mechanisms underling the high degree of familiarity. Assortative mating was highlighted as particularly characteristic of the family profiles of this group, leading to a high prevalence of parental antisocial behaviour and its associated adverse family characteristics, the combination of which was proposed as highly likely to create environmental risks. Genetic effects were suggested to manifest themselves via a heightened sensitivity to environmental risk. Thus, genetic influences were proposed to be important for both ADHD and antisocial behaviour, but the mechanisms by which they operate were found to be very different. This finding is consistent with Nigg and Huang-Pollock's (2003) notion that executive dysfunction exerts a direct influence on hyperactivity, whereas the impact of executive impairments on conduct problems were hypothesised to be mediated by environmental adversity. Thus, cognitive vulnerability per se may not be sufficient to cause conduct problems, but in conjunction with a high-risk environment the onset of conduct problems may be more likely. Hyperactivity on the other hand appears to follow a more heritable, organic causal route.

Studies of older children with established clinically diagnosed behaviour problems have also reported that cognitive impairments are more pronounced in children with hyperactivity than those with conduct problems. Buitelaar, van der Wees, Swaab-Barneveld & van der Gaag (1999), for example, found theory of mind deficits in children with ADHD but not in children with conduct problems, and suggested that frontal theories of ADHD (e.g. Barkley, 1997; see below) were perhaps not as applicable to children with conduct problems as some theorists (e.g. Raine, 2002) have suggested. Buitelaar et al (1999) therefore proposed, in line with Rutter et al (1999), that cognitive impairments are stronger and more pervasive in children with hyperactivity.

It is worth considering briefly at this juncture some of the prevailing theories attesting to the core deficit in hyperactivity. Whilst not the primary focus of this thesis, by examining models of hyperactivity we can begin to determine which models have also been applied to explain conduct problems, and which if any have been applied specifically to hyperactivity. Since the present study is concerned with cognitive and behavioural processes pertinent to conduct problems, an examination of all aspects of cognition thought to underlie hyperactivity specifically is beyond the scope of this thesis. However, it is important to be aware of other potentially important aspects of functioning which have not been considered in the present thesis, which could either differentiate between conduct problems and hyperactivity or indeed constitute a shared deficit of both aspects of behavioural dysfunction. Thus, an awareness of the limitations of the measures used in the present thesis is afforded by this review.

Perhaps the most renowned theory of hyperactivity is Barkley's (1997) inhibition hypothesis. Barkley proposed that the core deficit underlying the combined type of ADHD (i.e. the combination of hyperactivity and inattention, as opposed to the predominantly inattentive type; APA, 1994) is a deficit in behavioural inhibition. This refers to 3 separate processes: inhibiting a pre-potent response, stopping an ongoing response, and the ability to filter out interference whilst deciding upon a response. Barkley argued that a child with a deficit in this capacity would by association also demonstrate impairments across 4 other aspects of executive function thought to be dependent upon behavioural inhibition. Namely, working memory (e.g. holding events in mind and acting upon them, imitating behaviour, having an accurate sense of time), emotional/ motivational self-regulation (e.g. controlling emotions during a goal-directed action, social perspective-taking), internalisation of speech (e.g. reflection, problem-solving, self-questioning, moral reasoning), and reconstitution (e.g. analysing behaviour, verbal fluency, behavioural creativity). Having difficulty with all of the above processes, the child would then be impaired in motor control, fluency and syntax. Thus, they would have trouble inhibiting task-irrelevant responses, be impaired in executing and persisting in goal-directed responses, have a poor capacity for re-engaging in a task following a distraction, and would be insensitive to response feedback and thus unable to adapt responses accordingly. All of these difficulties are characteristic of the symptoms associated with hyperactivity. As explored in section 1.5.3, the inhibition hypothesis has since been applied to explain the underlying deficits responsible for anti-social behaviour or conduct problems (Raine, 2002). Some studies have suggested that this is purely by virtue of co-morbid hyperactivity (Berlin & Bohlin, 2002), whilst others have hypothesised that the deficit underlying conduct problems is related to inhibitory control, but that the impact of the deficit on behaviour is mediated by environmental risk rather than directly causal (Nigg & Huang-Pollock, 2003).

Other researchers have argued that rather than a deficit in inhibitory control or indeed a more general impairment in executive functioning, the core deficit in hyperactive children is in fact "delay aversion" (Sonuga-Barke, Houlberg & Hall, 1994). This hypothesis arose from the observation that when presented with the choice of an immediate but small reward, or a delayed yet more substantial reward, hyperactive children would only opt for the immediate reward if the strategy reduced the overall waiting period. Thus, if choosing the immediate reward resulted in having to wait longer for the delayed reward, the hyperactive children would choose the delayed reward (Sonuga-Barke, Taylor, Sembi & Smith, 1992). Thus it seemed that rather than being *unable* to wait, as one would predict based on the inhibition hypothesis, the children simply *chose* not to wait if it reduced the overall period of delay. The lack of behavioural inhibition therefore seemed to reflect motivational factors rather than a cognitive deficit per se. They seemed aversive to delay, but not incapable of it. Thus, the theory might explain the phenomenon that hyperactive children often fidget in their chair, talk a lot and move around between tasks during testing, presumably in an attempt to minimise the discomfort caused by the delay or lack of activity.

Delay aversion has not been formally proposed as a core deficit underlying conduct problems. However, Kuntsi, Oosterlaan and Stevenson (2001) reported that in their study of pervasively hyperactive twins, the group differences between the hyperactive and non-hyperactive children on the delay aversion task no longer reached significance when controlling for concurrent conduct problems. It is plausible therefore that in fact delay aversion characterises children with conduct problems, and that the deficit has only been observed in hyperactive children because hyperactive children often display conduct problems. Alternatively, delay aversion might be associated specifically with the "conduct problems + hyperactivity" sub-type, which could be evidence that this profile of behaviour does indeed represent a qualitatively distinct disorder with stronger neuropsychological underpinnings (Lynam, 1996). Delay aversion is not measured in the present study, but it is worth noting that this is another potential risk factor for severe and enduring conduct problems.

Another theory used to explain the origins of hyperactive behaviour is the "state regulation" model of hyperactivity (Van der Meere, 1996). In this model, Van der Meere proposed that hyperactive children have no deficit in cognitive processing capacities, but rather they present with a low level of activation or effort, perhaps due to a propensity towards sensation-seeking and a susceptibility to boredom. Thus, unless a particularly stimulating or rewarding task is presented to them, they will not make full use of their cognitive capacity to complete the task and will engage in a mode of responding consistent with slow information processing.

Preliminary support for the theory was presented by Kuntsi et al (2001). They observed that on a task measuring inhibitory control (the "Stop Task", Oosterlaan & Sergeant, 1998), hyperactive children presented with a pattern of responding consistent with the state regulation hypothesis. The task requires children to respond to an aeroplane appearing on a computer screen by touching a button immediately on the side corresponding to the appearance of the plane. On the "Stop" trials the child must not respond. Despite the fact that, contrary to the inhibition hypothesis, the hyperactive children were not less likely than the non-hyperactive children to inhibit their responding on the "stop" trials, they were significantly slower, more variable and less accurate (making more errors) than the non-hyperactive group on the "Go" trials. This is indicative of a slow information processing system on the part of the hyperactive children, and this pattern of responding continued to distinguish the groups even when controlling for co-morbid conduct problems, indicating that poor state regulation could be specific to hyperactivity.

Kuntsi et al's (2001) study does not necessarily contradict Barkley's (1997) inhibition hypothesis. The Stop task measures a particular type of inhibition (response inhibition) and does not measure other aspects of inhibition pertinent to Barkley's theory, such as inhibiting an ongoing response or interference avoidance. However, the fact that other processes not covered by Barkley's theory seem to be associated with hyperactivity, such as slow information processing or "poor state regulation", suggests that perhaps Barkley's theory is in need of review (Kuntsi et al, 2001).

1.8 Pervasive versus situational conduct problems

Conduct problems must be present across more than one setting in order to qualify for a diagnosis of conduct disorder (DSM-IV; APA, 1994). This is based on the established findings that pervasive conduct problems are predictive of significantly poorer outcome than situational conduct problems. For example, Loeber (1990) asserted in his "multiple setting hypothesis" that children displaying antisocial behaviour in more than one context, for example at home and at school, were at greater risk for becoming chronic offenders. He used as support a number of research studies that have demonstrated a worse outcome for children with pervasive behaviour problems compared with children with situational behaviour problems. Mitchell and Rosa (1981) for example, found that when either the parent or the teacher (but not both) classified children as "stealers", 14.3% (rated by parents only) and 45.5% (rated by teachers only) continued to steal later in life. The recidivism figure increased to 71.4% when both parents and teachers rated the children as "stealers". Similar results were found with regard to lying.

Few studies to date have looked at pervasive symptoms in the pre-school years to determine how early cross-setting behaviour problems may arise and whether they could be differentially predictive of poor long-term outcome compared with children with situational problems, even at such an early age. Many of the risk factors discussed above might predict or result from the pervasiveness of the conduct problems displayed. The pervasiveness of conduct problems will therefore be considered as dependent rather than independent variables, in order to determine the differential associations these sub-types of conduct problems might have with the risk factors considered above.

1.9 Gender differences in conduct problems

Whilst our understanding of the prevalence, developmental course, underlying mechanisms and causal factors of conduct problems has advanced in recent years, the majority of the studies conducted to inform our understanding are based on samples of boys (Keenan, Loeber & Green, 1999). Relatively few studies have been conducted on girls, and hence the extent to which findings based on studies of boys can be reliably applied to girls is questionable.

Part of the rationale behind the majority of studies focusing on boys has been in the assumption that conduct problems are less common in girls and have a less serious impact on society (Keenan et al, 1999). Nevertheless, there is some evidence pointing towards an increase in the prevalence of delinquency in girls in recent years (Farrington, 1987; Robins, 1986), and a considerable body of research indicating serious negative outcome for girls with conduct problems, ranging from increased mortality (Pajer, 1998) to the likelihood of finding antisocial partners (Robins, 1991) and its consequential association with the likelihood of raising children with conduct problems.

Thus, understanding the developmental pathways associated with conduct problems in girls is equally important as understanding the processes in boys. Differences in the development, course and prognosis of conduct problems between boys and girls might have significant implications for the prevention, diagnosis and treatment of conduct problems in girls (Keenan et al, 1999). Accordingly, what do we know about gender differences in conduct problems? There is some evidence that girls and boys display similar levels of behaviour problems at age 3 (Keenan & Shaw, 1994; Rose, Rose & Feldman, 1989), whereas by age 4 boys begin to present with more externalising problems whilst levels of internalising problems remain at similar levels (Offord et al, 1987). At adolescence boys continue to show higher levels of externalising problems whilst girls show higher levels of internalising problems (Simonoff et al, 1997). In fact, by adulthood the ratio of depression in females to males is 2:1 (Angold & Rutter, 1992). In terms of the continuity of conduct problems from school age, the consensus in the literature is that both boys and girls are equally likely to continue to exhibit conduct problems later (e.g. Tremblay et al, 1992), although not enough evidence exists to apply Moffitt's theory regarding the early-late onset distinction to girls (Moffitt, 1993). Thus, it is unclear whether conduct problems emerging early in development constitute a heightened risk for poor outcome in girls as is the case with boys.

With regard to the presentation of conduct problems, some researchers have suggested that the apparent lower prevalence of conduct problems in girls is due to a different presentation of symptoms, labelled "indirect" or "social aggression" (Bjorkqvist, Lagerspetz & Kaukiainen, 1992; Crick & Grotpeter, 1995). Social aggression refers to inflicting harm on another person in indirect ways such as by talking behind the person's back or spreading rumours. Nevertheless, when Galen and Underwood (1997) investigated gender differences in social aggression they found that girls reported similar rates of socially aggressive acts but that girls attributed greater seriousness than boys in terms of the harm inflicted for both social and physical acts of aggression. Thus, it is possible that girls in fact do not display higher levels of social aggression than boys but that they are more sensitive to it.

The presentation of conduct problems in girls also differs from boys in terms of the comorbidity with other disorders. Robins (1986) noted that women with a history of conduct problems tended to be at increased risk for almost every other disorder. As Keenan et al (1999) noted, examining comorbid disorders is an important task given that the seriousness of a diagnosis might differ depending on the type or extent of the comorbid condition (Patemite, Loney & Roberts, 1995). Findings from the Ontario Health Study revealed that 31.3% of girls and 18.6% of boys presenting with conduct disorder also had a comorbid emotional disorder at age 4-11. Comorbidity increased for girls in adolescence to 48.1%, and yet decreased in boys to 15.3% (Offord, Adler & Boyle, 1986). The high degree of comorbidity between CD and depression in girls poses a significant cause for concern. Girls with comorbid symptoms of CD and depression are at increased risk for suicide, above and beyond that associated with boys with the same profile of symptoms, despite the fact that suicide rates are five times higher for boys than girls in the adolescent population (Joffe, Offord & Boyle, 1988; Shaffer, 1988).

Cummings, Pepler & Moore (1999) presented evidence pertaining to a difference between boys and girls with regard to the impact of family violence on behaviour. The evidence suggested that the development of aggressive behaviour in girls has a tendency to occur in the context of familial relationships, in particular with their mothers. Moreover, mothers' psychological adjustment better predicted daughters' than sons' behavioural adjustment. Other research has also pointed towards girls being more sensitive than boys to disruptions in their social environment. Girls in divorced families, for example, were reported to show a significant increase in externalising behaviours in comparison with boys according to mothers (Anderson, 1993). Nevertheless, the opposite finding has also been reported, indicating that males may be more sensitive to familial stress factors such as divorce or overcrowding in the home (Wachs, 1992), and yet others have reported that the same family risk predictors are predictive of antisocial behaviour for boys and girls (Moffitt, Caspi, Rutter & Silva, 2001). It may also be the case that the reason for the discrepancy in girls' and boys' reactivity to environmental stressors (assuming that the contrary findings in the literature can be addressed and establish whether boys or girls are more vulnerable) is not the fact that boys or girls are more sensitive to stress but rather that they are treated differently during times of family stress (Rothbaum & Weisz, 1994).

Research has revealed somewhat inconsistent findings regarding the association of IQ and verbal deficits with conduct problems in boys versus girls. Olson and Hoza (1993) found that vocabulary levels were negatively correlated with conduct problems for girls but not for boys, although the opposite has been found with regard to reading ability in that poor performance was associated with conduct problems for boys but not for girls (McGee, Feehan, Williams & Anderson, 1992). In the Waltham Forest Study (Richman, Stevenson & Graham, 1982), across the whole sample at age 3 boys with behaviour problems performed significantly worse at verbal comprehension and hand-eye co-ordination than boys without behaviour problems. However, this was not true of girls for whom there were no differences in cognitive ability associated with the presence or absence of behaviour problems. At age 4, boys' performance on the WPPSI scales was poorer in the problem behaviour group than in the control group, whereas girls displayed no such differences.

Moreover, Sonuga-Barke et al (1994) found that behaviour problems in pre-school girls were associated with developmental advantage in that girls, but not boys, with behaviour problems tended to have higher IQs than those without behaviour problems. The authors suggested that perhaps more intelligent children are more inquisitive and demanding, but that this is labelled as behaviourally inappropriate for girls but not for boys. Evidence suggests that this difference does not continue into middle childhood however. Robins (1986) reported that school drop-out and unemployment were equally likely for delinquent boys and girls in later childhood and adolescence. Two possible explanations for this phenomenon were put forward. Girls with high IQs may grow out of conduct problems, and thus the girls in middle childhood presenting with conduct problems are either not the same girls who presented with conduct problems at pre-school or are a small subset of them. Alternatively, following a period of time in which the high IQ girls engage in antisocial behaviour, the behaviour and its consequences begin to impact upon the girls' intellectual functioning.

The consensus appears to be that boys with conduct problems tend to present with a profile of cognitive delay across verbal and non-verbal domains, whilst girls do not seem to display associated cognitive deficits alongside conduct problems. Might this be due to girls having a different profile of risk associated with the onset and maintenance of conduct problems to boys, or simply that boys are more likely to develop or be exposed to risk factors which are the same for both boys and girls?

Moffitt et al (2001) found that in the follow-up of the Dunedin cohort at age 21 (from the Dunedin Epidemiological Study described above; Silva, 1990), compromised intellectual and neurological functioning at age 5 were predictive of antisocial behaviour for both males and females. They used a range of measures, including memory test batteries, verbal and non-verbal IQ, neurological abnormalities, and reading tests. These findings were consistent with findings from the same study relating to environmental and familial risk factors for antisocial behaviour. Moffitt et al concluded therefore that rather than being differentially affected by risk factors, males and females must be differentially exposed to risk factors. Indeed, when exposure to risk factors was investigated, it emerged that boys had higher rates of neuro-cognitive deficits (including memory, verbal and non-verbal IQ, and reading ability), more hyperactivity, and more peer problems than girls, and that these gender differences accounted for one half to two thirds of the gender differences in antisocial behaviour. The most important risk factors associated with gender differences were hyperactivity, which accounted for more than two-thirds of the gender differences in antisocial behaviour, and peer problems, which accounted for one-quarter of the gender differences in antisocial behaviour. Family adversity on the other hand was not associated with gender differences in antisocial behaviour, although it was a risk factor across gender.

There are innumerable reasons for the gender differences in both risk factor profiles and levels of conduct problems. As mentioned previously in section 1.1.3, Caspi et al (2002) identified a gene on the X chromosome as a possible risk factor for the development of violent behaviour in the context of maltreatment. It is possible that this and other genetic and biological factors may predispose boys to violent and antisocial behaviour above and beyond that of girls. X-linked genes are likely to identify more boys than girls due to boys only having one copy of the X chromosome, although as mentioned previously the MAOA gene may be subject to X inactivation (Rutter et al; 2003), rendering the polymorphism equally likely to be present in boys and girls. This issue aside, it is certainly true that boys' genetic and biological make-up makes them vulnerable to a number of disorders, of which autism, AD/HD and Tourettes syndrome are just a few examples. Hormones have also been implicated in the aetiology of conduct problems and antisocial behaviour, with androgen receptors in the limbic system associated with aggression in males (Herbert & Martinez, 2001). Hill (2002) suggested that hormones could influence behaviour in one of two ways, either by exerting enduring influence on brain structure or by hormonal activation of existing brain structure. Hormonal accounts could also help explain the temporary rise in conduct problems seen during adolescence in both boys and girls (Moffitt, 1993), with elevated hormone levels characteristic of both genders during this time period.

In an investigation of factors differentiating early-onset persistent aggression from adolescent-onset aggression, Brennan et al (2003) reported some important gender differences. Not only were boys more likely than girls to fall into the "early-onset persistent" category at age 15, but moreover results were consistent with a theory denoting an interaction between social and biological risk factors in boys' persistent aggressive behaviour, whilst only social risk factors differentiated girls with early-onset aggression from adolescence-onset aggression. Biological risks included perinatal and birth complications; maternal illness during pregnancy; infant temperament; poor vocabulary and deficits in executive functioning. Social risks were concerned with parental negative attitudes and parenting practices; parental educational level; and exposure to poverty and stressful life events. Although one may contest the notion that all of the aforementioned risk factors fit neatly into "biological" or "social" categories (parental educational level for example could be considered a biological risk factor since it may depend upon intellectual ability), clearly a larger number of potentially biological or inherited risk factors were associated with boys' persistent aggressive behaviour. This, alongside the fact that more boys than girls presented with the most severe behavioural classification, implicates a stronger genetic or biological component to boys' aggressive behaviour than girls.

Nevertheless, genetic and biological factors alone do not explain the fact that not all boys go on to develop conduct problems, and not all girls are immune. Indeed, how might genetic models of antisocial behaviour account for the fact that conduct problems show a more or less equal prevalence across gender in the preschool period? Presumably a genetic predisposition from which girls then recover would be the only plausible explanation, which seems unlikely. There must therefore also be social factors accounting for boys' relatively poor risk factor profile. Parents and teachers may socialise boys and girls differently, with certain behaviours being reinforced for boys yet unacceptable for girls (Moffitt et al, 2001). Socialisation could contribute to a number of social gender differences, such as the peer group culture of risk-taking, domineering and status-oriented interactions characteristic of boys (Maccoby, 1998) that has been shown to contribute to the gender differences in antisocial behaviour (Moffitt et al, 2001).

Caution should be urged against the assumption that girls' remission from conduct problems in later development is suggestive of a complete recovery from any form of psychological distress or disorder. Simonoff et al (1997) noted that internalising disorders are substantially more prevalent in women than men in adulthood, whilst this is not the case early in development. Could it be therefore that girls initially presenting with conduct problems in the pre-school period are socialised to express their psychological distress in other ways, and that as girls get older their externalising problems become internalised? It is important therefore to understand more about the presentation of boys and girls in early childhood with regard to risk factors associated with early conduct problems. The developmental pathways leading to increased risk for continued conduct problems for boys and internalising problems for girls can thus begin to be disentangled.

In summary, a dearth of research has been conducted with regard to gender differences in the development, course and prognosis of conduct problems (Keenan et al, 1999). Boys and girls have been shown to display similar levels of behaviour problems in the preschool period, but by adulthood a propensity towards internalising problems for females and continued conduct problems for males prevails (Offord et al, 1987). This thesis therefore also aims to investigate gender differences in the prevalence of conduct problems at age 3, and the associated risk factor profiles displayed by boys and girls with conduct problems. Research to date has provided inconclusive evidence in favour of girls' superior intellectual ability compared with boys presenting with conduct problems (e.g. Richman et al, 1982), which might act as a protective factor for girls against continued conduct problems later in life. This chapter seeks to replicate the finding and to investigate the role of other risk factors not previously studied, in determining the reasons behind the divergent developmental pathways taken by boys and girls later in life. In addition, discovering the profile for girls associated with continued conduct problems is also an important task for research initiatives such as this, particularly in the light of findings relating to the increased co-morbidity of disorders in women with externalising problems and the poor prognosis associated with such a cocktail of symptoms (Joffe et al, 1988).

1.10 Chapter summary

- Substantial continuity of antisocial behaviour from childhood throughout the lifespan has been consistently reported (Farrington & Hawkins, 1991), and the most persistent and serious antisocial individuals are proposed to begin to display conduct problems early in life (Moffitt, 1993). We should be cautious in early identification however, since only a small proportion of children "at risk" will go on to become serious offenders (Bennett et al, 1998).
- Several "child risk factors" are associated with severe and persistent conduct problems:
    - Poor non-verbal IQ and verbal ability, particularly verbal ability (Elkins et al, 1997; Henry, Moffitt & Silva, 1992): Is this a cause, a consequence or a marker for conduct problems (Goodman et al, 1995)?
    - Poor theory of mind (Hughes et al, 1998; Happé & Frith, 1996).
    - Poor inhibitory control (Raine, 2002).
    - Poor social skills (Webster-Stratton, 1991; Goodman & Stevenson, 2001): Is this due to a social information processing deficit (Dodge et al, 1990), or do conduct problems lead to social skills deficits indirectly (Parker & Asher, 1987)?
    - Co-morbid hyperactivity (Moffitt, 1990; Babinski et al, 1999): Is this condition predictive of poorer outcome and associated with more deficits because of the sheer number of symptoms (Hill, 2002), are conduct problems a complication of earlier hyperactivity (Taylor et al, 1996), or is "conduct + hyperactivity" a qualitatively distinct disorder with a particularly poor prognosis (Lynam, 1996)?
- Comorbidity with hyperactivity could potentially account for all of the above risk factors (Hill, 2002). This has been proposed particularly with regard to IQ (Hinshaw, 1992), IC (Berlin & Bohlin, 2002) and ToM (Buitelaar et al, 1999).
- Research into the aetiology and maintenance of conduct problems has largely focused on boys. Future studies should investigate the causal mechanisms and developmental trajectories of conduct problems in girls to determine whether theories derived from studies of boys can be applied to girls, or whether gender-specific models are appropriate (Keenan et al, 1999).

2

"At risk" at age 3: Cross-sectional categorical analyses

2.1 Assimilation of the literature and chapter aims and hypotheses

It is clear from the literature presented in chapter 1 that severe and enduring forms of antisocial behaviour beginning early in life are a major concern both for intervention and research initiatives (e.g. Moffitt, 1993). Since only a minority of pre-school children presenting with behaviour problems are likely to engage in antisocial and criminal activities later in life (Bennett et al, 1998), it is important to understand more about the early presentation of later antisocial behaviour. Is the type or severity of behaviour different for these children, or are there other associated risk factors present which might indicate a greater likelihood of enduring problems? Once a more accurate picture of the indicators of later serious antisocial behaviour is established it will be possible for clinicians to more accurately identify children who would benefit most from early intervention. Thus, research into the early markers of enduring behaviour problems could make an important contribution towards preventing some of the most serious problems in society caused by antisocial behaviour.

This chapter therefore sought to investigate factors associated with early emerging conduct problems in the pre-school years. In addition, given the dearth of research into antisocial behaviour in girls (Keenan et al, 1999), another aim was to study gender differences in the prevalence of early conduct problems as well as in the concurrent factors associated with such behaviour. Understanding gender differences in the presentation and continuity of conduct problems at this early age might identify potential markers to account for the divergent developmental pathways taken by boys and girls as they reach adulthood, whereby a greater prevalence of antisocial behaviour in males and a greater propensity towards internalising problems in females tends to operate (e.g. Offord et al, 1987; Simonoff et al, 1997).

Previous studies have reported that deficits in non-verbal and verbal ability, particularly the latter, tend to characterise individuals with particularly severe and enduring conduct problems (e.g. Henry, Moffitt & Silva, 1992). The exact mechanism underlying this association is still open to speculation, with accounts ranging from cognitive deficits playing a causal role in the development of conduct problems (Luria, 1971; Rutter, 2003), through to the notion that conduct problems could cause impaired cognitive functioning, either through disruptions to the acquisition of new skills or interference with task performance (Goodman et al, 1995). It was hypothesised, drawing on Moffitt's (1993) contention that "life course persistent" antisocial individuals display conduct problems early in life, and that such individuals would be likely to show deficits in cognitive functioning, that children "at risk" for conduct problems at age 3 would differ from their "low risk" peers by virtue of relative impairments in non-verbal and particularly verbal ability. Such a finding would offer support for the notion that "life course persistent" individuals could potentially be identifiable as early as age 3.

As well as considering non-verbal and verbal ability as cognitive "risk factors", the role of 2 new aspects of cognition which have recently been studied in relation to conduct problems shall also be examined. The first is the concept of "theory of mind" competency, referring to the ability to attribute beliefs and intentions to others in order to understand and predict behaviour. This ability, measured by false belief tasks, was found to be delayed in "hard to manage" children at 4 years old, relative to comparison children with no behaviour problems (Hughes et al, 1998). Hughes et al also found evidence for a "skewed" theory of mind towards a more accurate prediction of emotion following a "nasty" than a "nice" surprise in the "hard to manage" group, despite the opposite pattern emerging in the comparison children, whereby they more accurately attributed feelings in the "nice" surprise condition. This notion is similar to Happé and Frith's (1996) hypothesis that children with conduct problems possess a "theory of nasty minds". In the present study, the "skewed" or "nasty" theory of mind hypothesis is not tested, but the notion that early-emerging conduct problems could be associated with a delayed or impaired theory of mind (Hughes et al, 1998) is examined, using standard false belief tasks and tasks tapping earlier-emerging mentalising abilities.

As yet, this aspect of cognition has not been specifically linked to severe and enduring antisocial behaviour, but by virtue of the associated problems likely to coincide with poor theory of mind, such as disruptions to pretend play (Taylor & Carlson, 1997) and to parent-child interaction (Ruffman, Perner & Parkin, 1999), it is hypothesised that a delay in theory of mind development alongside early conduct problems would constitute risk for continued conduct problems. Theory of mind impairments have been found in one previous study of "hard to manage" children a year older than the present sample (Hughes et al, 1998). An aim of the present study is therefore to determine whether this finding could be replicated in a younger sample, implicating theory of mind impairments in the processes associated with risk for conduct problems in children as young as age 3.

The second relatively new aspect of cognition to be considered as a "risk factor" for continued and/or worsening conduct problems in a group of children showing early risk, is the capacity to inhibit a dominant or pre-potent response, a process referred to as inhibitory control. Raine (2002) proposed that dysfunction in the prefrontal cortex in the brain predisposes children to antisocial behaviour by limiting the capacity for inhibitory control. Thus, the child is ill-equipped to consider the consequences of their actions and to change their responses to situations accordingly. Indeed, deficits in inhibitory control have been reported to distinguish adults with violent and psychopathic tendencies from other offenders (Henry & Moffitt, 1997), with the hypothesis that this deficit could constitute risk for a particularly severe profile of antisocial behaviour. Hughes et al (1998) reported that their "hard to manage" group were also impaired in the capacity to inhibit a pre-potent response relative to the control group, suggesting that inhibitory control processes may already be disrupted in children presenting with very early signs of antisocial behaviour as young as age 4. The present chapter aims to determine whether children "at risk" at age 3, a year younger than Hughes et al's sample, could also be distinguished from their low-risk peers with regard to poorer functioning on inhibitory control tasks. Such a finding would offer some confirmation for the risk status of these children, although the fact that inhibitory processes are suggested to undergo a period of significant development during the pre-school years (Diamond & Taylor, 1996) might indicate that deficits in these abilities may not be discernable as early as age 3.

Alongside the above "cognitive" risk factors, the present chapter also examines the role of social skills and hyperactivity in increasing the risk that early conduct problems will persist or worsen in the future. Social skills at age 3 have been reported to predict adult criminal convictions, particularly violent convictions (Stevenson & Goodman, 2001), and many interventions designed to improve the behaviour of children with conduct disorder concentrate on improving social skills in order to engender change in antisocial behaviour (Webster-Stratton, 1991). Whether social skills deficits lead to conduct problems via a paucity of opportunities for positive social interactions (Parker & Asher, 1987) or whether antisocial behaviour leads to poor social skills through the frustrations brought about by peer rejection (Wood, Cowan & Baker, 2002), it is clear that the two aspects of behaviour in combination constitute high risk for later problems. We hypothesise therefore that "at risk" children identified at age 3 would be likely to display deficient social skills in comparison with their low risk peers, and that this profile of impairment may represent risk for enduring conduct problems.

Consistent findings in the literature also attest to the increased risk afforded by the combination of both conduct problems and hyperactivity. For example, the profile is associated with impaired cognitive functioning and highly aggressive behaviour compared with children presenting with conduct problems or hyperactivity alone (Moffitt, 1990), and risk for later criminal activity is also greater if children present with the combination of hyperactivity and conduct problems than either symptom profile alone (Babinski et al, 1999). It is thus hypothesised that hyperactivity will act as a risk factor for severe and enduring conduct problems, and that "at risk" children at age 3, likely to include a proportion of "life-course persistent" individuals (Moffitt, 1993), will receive higher hyperactivity ratings than low-risk children.

Since Loeber (1990) suggested that conduct problems which occur across settings are more likely to persist and are likely to be more severe in nature than conduct problems which are context-specific, another hypothesis for the present chapter is that children presenting with "pervasive" risk for conduct problems shall present with a poorer risk factor profile than children with "situational" risk, and are therefore more likely to show persistent and severe conduct problems in the future.

Finally, the risk factor profiles of girls and boys "at risk" for conduct problems at age 3 shall be compared. There is some evidence in the literature that levels of conduct problems are similar for girls and boys early in development (Keenan & Shaw, 1994; Rose, Rose & Feldman, 1989), although findings are inconsistent (Offord et al, 1987). Accordingly, this chapter aimed to investigate the proportion of boys and girls presenting with conduct problems at age 3.

With regard to the potential for differential risk factor profiles of "at risk" boys and girls, the fact that few studies have investigated gender differences makes this difficult to predict (Keenan et al, 1999). Some theorists have argued that Moffitt's (1993) "early-onset/ persistent" developmental taxonomy might not be applicable to girls (Silverthorn & Frick, 1999), and others have proposed that whilst such a taxonomy can be applied to girls, fewer girls than boys with present with such a profile (Brennan et al, 2003). These theories suggest that girls identified "at risk" at age 3 might be less likely than boys to represent "life course persistent" individuals, by virtue of their greater behavioural variability prior to adolescence.

If "at risk" girls are indeed less likely to represent "life course persistent" individuals than boys, it is of interest whether gender differences in the risk factor profiles of "at risk" boys and girls might be discernable, which might help explain the different developmental pathways of boys and girls later in life. There is reason to hypothesise that, based on previous research, "at risk" girls might be expected to show less impairment than "at risk" boys on at least some of the above risk factors.

One plausible explanation for the observation that fewer girls than boys present with antisocial behaviour and conduct problems later in life (Simonoff et al, 1997) could be that girls have superior cognitive functioning which might act as a protective factor against continued conduct problems. This could manifest itself in a greater likelihood to benefit from interventions due to greater insight into the impact of their behaviour on others, or to the heightened chances of high academic achievement afforded by the superior cognitive ability in girls. Thus they might be considered less likely to suffer the consequences of poor school attainment such as poor relationships with teachers or school drop-out which might exacerbate conduct problems in boys. Richman et al (1982) reported that girls with behaviour problems at age 3 did not present with deficits in cognitive functioning relative to girls without behaviour problems, whereas boys with behaviour problems were presenting with impaired cognitive functioning in comparison with boys without behaviour problems. In addition, the "behaviour problem" boys were more likely to continue to display behaviour problems at age 8 than "behaviour problem" girls. Possibly the superior cognitive functioning on the part of the girls contributed to their desistence. Moffitt et al (2001) also reported that whilst poorer functioning at age 5 on aspects of verbal ability, non-verbal ability, reading ability and memory were predictive of later antisocial behaviour in boys and girls, boys were more likely than girls to present with poorer functioning on these aspects of cognition.

Adopting the above hypothesis it was anticipated that girls "at risk" for early conduct problems would display relatively superior performance in cognitive functioning in comparison to boys "at risk" for early conduct problems. This chapter aimed to explore this further by measuring aspects of verbal and non-verbal cognitive ability to determine whether a specific type of intellectual functioning is associated with gender differences within the conduct problems group.

Convergent findings in the literature have pointed towards superior social skills in girls throughout development (Bosacki & Astington, 1999; Matthews & Keating, 1995), and social skills deficits alongside conduct problems are associated with numerous complications predictive of poor outcome, such as peer rejection (Wood, Cowan & Baker, 2002). Boys have been shown to be more susceptible to peer problems and this has been found to contribute to gender differences in antisocial behaviour (Moffitt et al, 2001). Taken together, these findings lead to the hypothesis that "at risk" boys will be expected to show deficits in social skills relative to "at risk" girls, and that this could in part explain girls' greater likelihood to desist from conduct problems. Social skills are thus conceptualised as protective factors against continued conduct problems for girls.

One further risk factor for which a gender difference within the "at risk" group might be hypothesised is hyperactivity. Boys have been shown to display higher levels of hyperactivity, which has been linked to gender differences in antisocial behaviour (Moffitt et al, 2001). Taken alongside the findings that co-morbidity between hyperactivity and conduct problems is associated with particularly severe and enduring antisocial behaviour (Babinski et al, 1999; Lynam, 1996), one can postulate that in the present chapter "at risk" boys will be expected to show higher levels of hyperactivity than "at risk" girls, and that this could in turn explain why boys are more likely than girls to continue in their antisocial careers.

One further point to note in relation to the present chapter, drawing on the literature reviewed in chapter 1, is the notion that co-morbid hyperactivity could account for some of the cognitive "risk factors" associated with conduct problems (Hill, 2002). For this reason, all analyses concerned with the risk factor profiles of "at risk" versus "low risk" children and indeed those concerned with boys versus girls within the "at risk" group, will control for the effects of co-morbid hyperactivity.

2.1.1 Summary of chapter 2 aims and hypotheses:

- Children "at risk" for conduct problems at age 3 will present with a poorer risk factor profile than "low risk" children in terms of:
    - Poorer non-verbal ability and particularly poorer verbal ability
    - Poorer social skills
    - Higher levels of hyperactivity
- Risk factor profiles of the "at risk" relative to "low risk" groups shall also be investigated with regard to 2 other areas of functioning which have received little attention in children so young:
    - Theory of mind
    - Inhibitory control
- Children with "pervasive" risk are expected to present with a poorer risk factor profile than children with "situational" risk. The specific areas of risk most strongly characteristic of children with pervasive risk shall be examined.
- Proportion of boys and girls falling into "at risk" group shall be examined to address inconsistent findings in the literature. Risk factor profiles of "at risk" boys relative to "at risk" girls shall also be investigated. Boys are expected to present with:
    - Poorer cognitive functioning. Whether any specific relative impairment in verbal versus non-verbal ability is evident in boys shall be investigated.
    - Poorer social skills
    - Higher levels of hyperactivity
- "At risk" boys and "at risk" girls shall also be compared with regard to the following cognitive risk factors:
    - Theory of mind
    - Inhibitory control
- All risk factor profile comparisons shall be conducted controlling for hyperactivity to test the hypothesis that risk factors associated with conduct problems are due to co-morbid hyperactivity.

2.2 Method

2.2.1 The nurseries

The sample was drawn from seven nurseries managed by the local education authorities of Camden and Islington in London, all providing care and education for children under 5 years of age. This study is concerned with the children in the 3- to 4-year "kindergarten" age group, as opposed to the baby and toddler groups also contained within the nurseries. One of the nursery sites was in Camden whilst the other six were located in Islington. The nurseries varied in size, and the number of new children entering the kindergarten group of the nurseries at a given intake ranged from 5 to 40, some of whom were new to the nursery and some of whom moved up from the toddler group. Most children attending the nurseries were from the local area, reflecting the cultural diversity of Camden and Islington. A percentage of the nursery places (differing from nursery to nursery, ranging from 12.8% through to 38.9%) were reserved for children referred by social services on account of their "Children in Need" (CIN) priority statement. This statement covers a wide range of categories, including children on the child protection register, children in foster families, and children known to local services for emotional or behavioural difficulties (see appendix A for the full statement listing all categories). These families received government-funded places since they were considered priority cases for nursery provisions. The rest of the families were fee-paying.

The nurseries were chosen by virtue of their location in deprived areas of London and for the high proportion of families with pre-identified need. This was an important consideration for a study seeking to maximise the number of children in the sample with early conduct problems, and it was anticipated that, given the above factors, there was a high likelihood that a large proportion of children "at risk" for conduct problems would be identified. It is well established in the literature that conduct problems thrive in the context of social and economic adversity (Campbell, Shaw & Gilliom, 2000). Thus, the fact that an average of 32% of children in the nurseries have pre-identified need is likely to increase the probability that high levels of early conduct problems will be identified within these nurseries. In addition, the areas of Camden and Islington in which the nurseries are located have been ranked as being amongst the top 6-16% most deprived in England on an index of multiple deprivation (IMD; Department of the Environment, Transport and the Regions, 2000). The IMD is a ward-level index based on six separate domains of deprivation, which are combined to form a rank score ranging from 1 (most deprived in England) to 8414 (least deprived in England). The domains of deprivation which make up the IMD are income; employment; health deprivation and disability; education, skills and training; housing; and geographical access to services. Each nursery was located in a different ward, the rank IMD scores of which ranged from 495 (top 6% most deprived) to 1358 (top 16% most deprived). Based on this information, a sample drawn from nurseries located in these deprived areas of London could be expected to include a high number of children "at risk" for the development of conduct problems.

2.2.2 Design

All families entering the kindergarten age group of the 7 nurseries between September 2001 and January 2003 were invited to take part in the research study. There were 4 cohorts of children made up of the following: Children starting nursery in and around September 2001 (cohort 1), children starting nursery in and around January 2002 (cohort 2), children starting nursery in and around September 2002 (cohort 3) and children starting nursery in and around January 2003 (cohort 4). Since the nurseries did not have a set twice-yearly intake, children entering the nurseries after the January data collection had taken place were recruited with the larger September intake. Similarly children entering the nurseries after the September intake but before January were included in the January cohort. Some children entering the kindergarten group were new to the nursery whilst others were transferred from the toddler group within the same nursery.

Data collection was staggered across the 7 nursery sites in 2-3 week data collection periods in each nursery. This procedure took place for each of the cohorts in turn. At the beginning of the data collection period in each nursery a list of names of the new intake of children was obtained from the nursery staff. All parents were then approached in person and invited to take part in the research study. Those who agreed signed a consent form and filled in the parent-completed questionnaires described below, either at the nursery, with the help of the experimenter and where appropriate an interpreter, or in their own time at home. Nursery staff were given the teacher questionnaires to complete once the children had settled into the nurseries for a minimum period of four weeks in order that they had time to become familiar with the children and so that any temporary changes in the children's behaviour due to starting at the nursery had passed. Finally the experimenter tested each child individually using the tasks described in section 2.3.5. The child testing took place at a separate table in the nursery class.

2.2.3 Participants: percentage of take-up and description of the sample

Across the four cohorts of the study, 368 families were eligible to take part. This figure reflects the number of new families entering the kindergarten groups in the nurseries between September 2001 and January 2003 (Cohorts 1, 2, 3 and 4). Of those 368 families, 218 were recruited to the study, a take-up of 59%. This percentage take-up figure of the eligible population compares favourably to other similar studies, for example Hughes, Dunn and White's (1998) investigation of theory of mind competency and executive functioning in pre-school "hard-to-manage" children. Before the "hard-to-manage" children were identified on the basis of scores over a designated threshold on a parent-completed behavioural checklist, the checklist was administered as a screening instrument to families of children attending 15 schools and nurseries. The aim was the screen all families of children attending these schools and nurseries, and the questionnaire was sent out to each family. 53.5% of the families returned the questionnaire and consented to take part in the study. Another study by Nigg, Quamma, Greenberg and Kusche (1999) obtained similar take-up figures to the present study. Nigg et al conducted a longitudinal investigation on a nonselected sample of elementary school children, and were interested in the influence of neuropsychological performance on later behavioural adjustment. Of the families invited to take part in the study (all families of appropriately-aged children in selected schools), 70% consented to take part.

Due to ethical considerations, only limited data regarding children whose parents did not actively opt into the study were available. One such data source was anonymised teacher report of behaviour on the SDQ and SSRS (see section 2.1.2 for details of measures). Of the total of 150 eligible families who chose not to opt into the study (368 minus 218) we had some teacher report of behaviour on 113 children (75.3%). Examining the SDQ conduct problems sub-scale, SDQ total problems score and SSRS overall standard score, the recruited (those who opted in) and the unrecruited (those who did not opt in) children for whom we had teacher report did not differ significantly. Specifically, mean scores for teacher SDQ conduct problems sub-scale were 1.44 in the recruited children and 1.78 in the unrecruited children (F (1, 275) = 1.75, n.s.). The mean score on the SDQ total problems scale was 8.01 in the recruited group compared with 8.87 in the unrecruited group (F (1, 275) = 1.49, n.s.).

Finally, the mean score on the SSRS standardised score was 94.07 in the recruited group, versus 94.19 in the unrecruited group (F (1, 211) = 0.00, n.s.).

The second source of data available regarding the unrecruited sample was information regarding their certified "in need" (CIN) status. Given that the nurseries were selected in part on the basis of the high proportion of children with CIN status, it is of interest what proportion of the recruited sample were CIN relative to the proportion of CIN children in the eligible population of the nurseries. This would illustrate the extent to which the recruited sample was representative of the population as a whole, at least with regard to "in need" status. The mean proportion of children "in need" in the eligible population of the nurseries across the seven nursery sites was 31.5%. The mean proportion of children recruited to the study who were "in need" was 19%, and it emerged that this difference in the proportion of "in need" children in the recruited versus the unrecruited samples was significant (χ^2 (1, 368) = 7.66, p<0.01). This information, coupled with the results reported above regarding the teacher-rated scores for the recruited versus unrecruited children, suggests that although the children we recruited to the study were less likely to be living in needy or disadvantaged social circumstances than the children we did not manage to recruit, their levels of behavioural pathology did not differ significantly. It is not known whether the "in need" children recruited to the study differed from the "in need" children not recruited to the study in terms of the category of CIN status they were in, since information regarding the specific categories of need was not available.

The sample consisted of 105 males and 113 females, ranging in age from 36 to 57 months (mean age 42.5 months, standard deviation 4.2 months). Only 7.3% of the parental informants completing the questionnaires were fathers. The other 92.7% were either mothers or female carers. 51% of those who responded (N=208) reported not being in employment at the time of completing the questionnaires. 210 people responded to the question regarding live-in partners, with 65% reporting that they had a live-in partner, and 17% of the live-in partners not being employed. This is a high rate of unemployment compared with the 39.4% unemployment in England and Wales reported in the 2001 Census (see http://www.statistics.gov.uk/census2001), highlighting the social deprivation of the present sample. Unemployment in the Census was broken down into several categories, including students, retired, permanently sick or disabled, and looking after home and family. In the present study information regarding the category of unemployment or reasons for unemployment was not obtained. Nevertheless, despite the high levels of unemployment it is notable that although fewer families were in employment than the national average, of those families that were in employment (referring to the highest status job in the household) a higher proportion were in professional occupations than in England (35% compared with 11% for England), and fewer families were in the lower socio-economic groups (for example 4% of the present sample were in SES category 9 (process, plant and machine operatives) compared with 12% in England). Thus, although less than half the sample were in employment, those who were tended to be in higher status jobs than the average for England.

Of the parents who completed the relevant section of the questionnaire (N=214), 30% had English as a second language. Information regarding ethnicity from 213 people was also collected and indicated that the sample was made up of a higher proportion of ethnic minority groups than in England overall (56% of white ethnic origin compared with 91% in England). More specifically, 6% were Black Caribbean, 10% were Black African, 4% were Other Black, 1% were Indian, 1% were Pakistani, 5% were Bangladeshi, 1% were Chinese, 1% were Other Asian, and 14% were Other or Mixed race. It is also notable that 35% of the sample reported having no live-in partner and looking after children alone. Compared with the 7% of lone parent families identified by the Census in 2001 in England and Wales overall, this highlights another area of social deprivation found in the present sample.

Overall, the sample presents a picture of a subset of socially deprived families with high levels of unemployment, ethnicity, one-parent families and English as a second language, alongside a middle-class, educated professional sub-set. Thus even within a group of nurseries chosen for their location in deprived areas of London, not all families are from socially disadvantaged backgrounds, reflecting the diversity of the population of inner-city London.

2.2.4 Identifying the "at risk", "low risk", "situational" and "pervasive" groups

For some of the analyses (in chapters 2 and 4) children were selected on the basis of the presence or absence of parent and teacher rated conduct problems, and hence children who did not fall into one of the two categories ("at risk" or "low risk") were excluded from these analyses. Other analyses looked at whole group effects and therefore included the whole sample (chapters 3, 5, 6 and 7).

The group of children falling into the "at risk" category was formed by identifying children above the 90th percentile cut-off on the conduct problems scale of the Strengths and Difficulties Questionnaire (SDQ; Goodman, 1997). The questionnaire is described in more detail in section 2.2.5 below. The rationale for the use of the 90th percentile as a cut-off point was based on the reported finding that SDQ scores above the 90th percentile have been demonstrated to predict an increased probability of independently rated psychiatric diagnoses (Goodman, 2001). The normative sample on which the cut-offs were derived was drawn from a nationally representative sample of 5-11 year old children (Meltzer, Gatward, Goodman & Ford, 2000). This normative sample was used in the absence of normative data for 3-4 year olds (Goodman, personal communication, August 2002).

Children rated by parents and/or teachers as falling above the cut-off were assigned to the "at risk" group. A second group of children with low levels of conduct problems according to both parents and teachers was identified, comprising of children scoring below the population 70th percentile cut-off on the conduct problems sub-scale for both parent and teacher-completed SDQs. This group was labelled the "low risk" group. Other studies comparing extreme scores on behavioural measures between "high" and "low" problem behaviour groups (notably Hughes et al, 1998) have used the 50th percentile as a cut-off point. However, the 50th percentile cut-off using the present sample did not identify sufficient numbers of children to analyse in comparison with the conduct problems group, and hence a more lenient definition of "low" problem behaviour was required which would still distinguish between children at extreme ends of the distribution with regard to behaviour problems. The 70th percentile was therefore considered the most appropriate cut-off point for this sample of children. Children not meeting criteria for either of the groups were excluded from the analyses focusing on the extreme groups. 98 children (52 boys and 46 girls) were excluded due to the grouping criteria, leaving a total of 120 children in the extremes analyses (53 boys, 67 girls).

With regard to the percentage of boys and girls from the whole sample of 218 who fell into the two "risk" categories, 28% of the boys (N=30) and 38% of the girls (N=42) from the sample fell into the "at risk" group, whilst 19% of the boys (N=23) and 21% of the girls (N=25) from the sample made up the "low risk" group. The difference between the distributions of gender in the two risk groups was not significant (χ^2 (1, 120) = .456, n.s.).

The total number of children in the "at risk" group therefore was 72, 42 of whom were rated by parents only, 18 of whom were rated by teachers only, and 12 of whom were rated by both parents and teachers. There were no significant differences in terms of the proportion of children from different ethnic origins in each group (χ^2 (8, 120) = 13.15, n.s.).

Since it was of interest whether children with "pervasive" conduct problems (i.e. identified by more than one informant) would differ from children with "situational" conduct problems (identified by only one informant) on other areas of functioning, two sub-categories were formed within the "at risk" group. These consisted of the 60 children with "situational" conduct problems (27 boys, 33 girls), and the 12 children with "pervasive" conduct problems (3 boys, 9 girls). The "at risk" group was broken down into these sub-categories for some analyses. Worthy of note, however, is that 16 of the children were in the situational group due to missing data on behalf of one of the informants. Thus, in the absence of both informants' ratings such children could not fall into the pervasive group, yet clearly it is possible that some of them would have if information from both sources had been available (see section 2.2.6 regarding missing data).

2.2.5 Measures

Verbal and non-verbal ability

Receptive language was measured using the British Picture Vocabulary Scale II (BPVS II; Dunn, Dunn, Whetton & Burley, 1997). The BPVS tests a child's vocabulary without the need for verbal response by presenting the child with four pictures and naming one of the items presented. The child's task is to point to the correct picture. The test is appropriate for assessing the receptive language of young people aged between 2.6 years to 21 years. Each set consists of 12 pictures, and the child progresses through the sets until they make eight or more errors in a set. From the raw score a standardised score is calculated with a mean of 100 and a standard deviation of 15. The following information regarding the test's reliability and validity was drawn from the figures reported in the BPVS manual (Dunn et al, 1997). Internal reliability was calculated at 0.86 (using the median of split half values for raw scores) and test-retest reliability was 0.75. Content validity was demonstrated via its inclusion of words from 18 categories to ensure breadth of vocabulary, as well as extensive checks of pictures and stimulus words to confirm that they were compatible with and relevant to British children. It was also reported in the manual that during test construction evidence for the construct validity of the BPVS was demonstrated. Mean raw scores in the standardisation sample indicated that the percentage of correct responses improved with age.

Nonverbal ability was assessed using the nonverbal scales of the Early Years version of the British Ability Scales II (BAS II; Elliott, Smith & McCulloch, 1996). The non-verbal scales of the Early Years version of the BAS comprise of subscales consisting of block building (below age 3.5 years only; building patterns with blocks by copying patterns modelled by the experimenter), picture similarities (matching a picture to one of four on a page with which it is most closely associated), pattern construction (above age 3.5 years only; timed exercise involving copying patterns with dual coloured squares from pictures or models) and copying (above age 3.5 years only; drawing exercise which requires copying a pattern from a picture presented to them). A non-verbal composite is derived from the raw scores on each subscale, yielding a "performance" or "non-verbal" IQ score with a mean of 100 and standard deviation of 15. Data regarding the reliability and validity of the test were reported in the manual (Elliott et al, 1996) and are as follows. The internal reliability relating to the mean of the Special Non-Verbal Composite of the Early Years version, including all ages, was calculated at .87. Test-retest reliability was reported to be .79. Concurrent validity was demonstrated by the correlations between composites of the BAS and the Wechsler Preschool and Primary Scale of Intelligence-Revised (WPPSI-R; Wechsler, 1989) and Wechsler Intelligence Scale for Children – III (WISC-III; Wechsler, 1974), other batteries assessing cognitive ability. The special non-verbal composite of the BAS II was correlated .52 with verbal IQ, .61 with performance IQ and .64 with full-scale IQ of the WPPSI-R, and .53 with verbal IQ, .66 with performance IQ and .72 with full-scale IQ of the WISC-III.

Parent Completed Measures

Parents completed a short questionnaire regarding demographic information for the purposes of describing the sample (see appendix B for this and all other parent-completed measures). Parents then rated their children's disruptive and prosocial behaviours using the 25-item Strengths and Difficulties Questionnaire (SDQ; Goodman, 1997, appendix B). The SDQ yields subscales relating to emotional problems, peer problems, conduct problems, hyperactivity and prosocial behaviour, each of which includes 5 items rated by the parent as "not true" (0 points), "somewhat true" (1 point), or "certainly true" (2 points). Thus, the minimum score for each sub-scale is 0 and the maximum is 10. All of the "difficulties" sub-scales (i.e. all but the prosocial sub-scale) are summed to make up the "total problems score" (minimum score 0, maximum score 40). The version of the questionnaire for 3-4 year olds was used in preference over the version for 4-16 year olds. The differences between the younger and older versions concern 2 items of the checklist which differ due to the developmental differences between the two age groups. In the 3-4 version, the item "Often argumentative with adults" (loading onto the conduct problems scale of the questionnaire) substitutes "Often lies or cheats" in the 4-16 version. In addition, the 3-4 version the item "Can be spiteful to others" (again, loading onto the conduct problems scale) replaces the item in the older version "Steals from home, school or elsewhere".

The sub-scale of particular relevance to the present study Is the "conduct problems" sub-scale, used to identify the "at risk" groups, and as a continuous variable in the dimensional and longitudinal chapters. The conduct problems sub-scale includes the same items on both the parent and teacher versions of the SDQ, which are the following: "Often has temper tantrums or hot tempers", "Generally obedient, usually does what adults request", "Often fights with other children or bullies them", "Often argumentative with adults" and "Can be spiteful to others".

Based on a national epidemiological sample of 10, 438 British 5-15 year olds rated on the SDQ by parents, teachers and self-reports, Goodman (2001) reported confirmatory data in support of the five areas of strength and difficulty measured by the SDQ (emotional, conduct, peer, hyperactivity-inattention and prosocial). This was demonstrated via independent psychiatric diagnoses of the same sample by a psychiatrist blind to the children's scores on the SDQ. Reliability was reported by the same study to be satisfactory (internal consistency measured by mean Cronbach score was .73; cross-informant correlation mean was 0.34; test-retest stability after 4-6 months was 0.62). Furthermore, the same study presented data indicating that SDQ scores above the 90th percentile were predictive of an increased probability of psychiatric diagnosis (mean odds ratios were calculated at 15.7 for the parent scales and 15.2 for the teacher scales).

In another study (Goodman & Scott, 1999), the validity of the SDQ was demonstrated via comparison with another behavioural checklist, the Child Behaviour Checklist (CBCL; Achenbach, 1991). The CBCL is a behaviour rating scale comprising of 113 behaviours falling into one of two broad categories: internalising and externalising syndromes. Internalising problems include overcontrolled, inhibited behaviours directed towards the self, whilst externalising problems relate to undercontrolled, aggressive behaviours directed towards others. A social competence scale is also included in the CBCL, which is concerned with children's involvement in various social activities such as clubs, jobs, chores, etc. The two questionnaires were found to be highly correlated and equally adept at discriminating between psychiatric cases and dental cases. In addition, the two questionnaires were compared with a semi-structured interview. The SDQ emerged as the better instrument for detecting symptoms of inattention and hyperactivity, whilst the two questionnaires were equally reliable at identifying internalising and externalising difficulties. Goodman (1997) has also demonstrated the SDQ to perform comparatively well at identifying psychiatric cases as the well-established Rutter parent and teacher questionnaires (Rutter, 1967; Rutter, Tizard & Whitmore,1970; Scahchar, Rutter & Smith, 1981). Furthermore, its less time-consuming nature has proven more popular with parents than some of the more cumbersome questionnaires (Goodman & Scott, 1999).

Child social skills were rated via the social skills scale of the preschool level Social Skills Rating Scale (SSRS; Gresham & Elliott, 1990, see appendix B). The SSRS social skills scale consists of 39 items related to children's social functioning, producing subscales of cooperation, assertion, responsibility and self control. A total score derived from the sum of the subscales is then converted into a standard score with a mean of 100 and standard deviation of 15. The problem behaviours scale was not used due to time constraints and the fact that the SDQ provided similar information. The manual for the SSRS (Gresham & Elliott, 1990) reports the reliability and validity of the instrument which have been demonstrated as follows. Internal consistency for the total score of the scale was .90, whilst test-retest reliability for the total scale score (calculated for the elementary standardisation sample only) was .87.

Teacher Completed Measures

Teachers also rated children's behaviour and social skills using teacher versions of the SDQ and Preschool level SSRS (see above; appendix C). The teacher version of the SDQ differs from the parent version by virtue of the supplementary impact section. In the parent version the impact of the child's difficulties are concerned with the extent to which they interfere with the child's home life, friendships, learning and leisure activities. In the teacher version, however, the questionnaire asks about the extent to which the difficulties interfere with only two domains of functioning: peer relationships and learning. Furthermore, the parent questionnaire includes an item regarding the burden of the difficulties on the family as a whole, whereas the teacher questionnaire is concerned with the burden on the class as a whole. This supplementary impact item was not used as a measure of pathology in the present study for a number of reasons. Firstly, due to the sheer number of questionnaires teachers were asked to complete, they often failed to complete this section of the SDQ, and hence there was a large amount of missing data on this item. Secondly, the impact item refers to the impact of the child's overall difficulties on the child's life, and as such does not refer specifically to conduct problems, which was the behaviour of primary concern in the present study. Thus, a high impact score could reflect the impact of any number of difficulties on the child's life, and might be concerned with problems of a predominantly emotional nature, or those reflecting prosocial behaviours or peer relationships, and would not necessarily reflect the impact of conduct problems or hyperactivity.

The teacher version of the SSRS differs slightly from the parent version in that it contains 30 items and refers to social functioning within the nursery setting. It yields the same subscales with the exception of self-control, which is not included in the teacher questionnaire.

Experimenter Completed Measures

An experimenter completed the Hillside Behaviour Rating Scale (HBRS; Gittelman & Klein, 1985, see appendix D), which assesses child symptoms of ADHD behaviour. The checklist was completed in reference to the child's behaviour during the testing session, after the child had completed with the same experimenter the BAS, BPVS and theory of mind and inhibitory control tasks. The checklist refers to seven ADHD behaviours (gross motor activity, distractibility and concentration, frustration tolerance, cooperation, interest in tasks, attention seeking devices and impulse control) across a five to seven point scale ranging from average to severe examples of each behaviour. The minimum score on the HBRS is thus 7 (reflecting low levels of hyperactivity) and the maximum score is 37 (reflecting very high levels of hyperactivity).

Theory of mind tasks

These tasks were designed to assess the child's "theory of mind", or mental representation. Theory of mind tasks tap a child's ability to form a mental representation of another person's perspective and to use that representation to predict the other person's actions or feelings.

The first theory of mind task used was the well-established "Sally Anne" False Belief Task developed by Wimmer and Perner (1983). In this task (see appendix E) the child was presented with two dolls named Sally and Anne. The child was shown that Sally had a basket and Anne had a box, and watched whilst the experimenter showed Sally putting a marble into her basket and then going for a walk. Whilst Sally was away, the experimenter demonstrated Anne taking the marble from the basket and putting it in the box. Finally Sally was brought back and the child was told Sally wanted to find her marble. The child was then asked the false belief question "Where will Sally look for her marble?" and two control questions designed to ascertain whether the child had correctly understood and remembered the story: "Where is the marble really?" and "Where was the marble at the beginning of the story?" This task aimed to tap the child's understanding that Sally would act on her false belief due to the fact that she did not know the real location. To do this the child would need to take Sally's perspective to predict her actions. Children were rated as successful only if they had answered all three questions correctly. The final score on the task was thus a dichotomous pass or fail score.

The second theory of mind task was the "Smarties" Unexpected Contents Task (Perner, Leekam & Wimmer, 1987). In this task (see appendix E) the child was presented with a prototypical "Smarties" box and asked "What do you think is in this box?" If the child answered correctly that they would expect Smarties to be in the box, they were shown that in fact the box contained unexpected contents, a pencil. The pencil was then placed back in the box and the child was asked two control questions to check that they had remembered their initial response as well as the actual contents: "What is really in the box?" and "When I first showed you the box, before you saw the pencil, what did you think was in the box?" Next the child was asked the test question "If we showed x (name of child's friend or key-worker) this box, who hasn't seen what's in it, what would s/he think was inside?" Passing the task demonstrated the child's understanding that someone who had not seen the contents of the box would base their answer on their false belief rather than reality. Again, in order to pass the task the child had to answer all questions correctly, and were scored as either having passed or failed.

Two additional theory of mind tasks were included which were developed for use with younger children, tapping abilities believed to be achieved earlier in development than false belief attribution. The first was the "not own belief" task (Wellman & Bartsch, 1988; appendix E). In this task the experimenter told the story of Sam who was searching for his lost dog, and the child was informed that the dog might be in the garden or he might be in the house. The experimenter then asked the child "Where do you think the dog is, in the garden or in the house?" Once the child had answered they were told that Sam thought the dog was in the opposite location to the child, and hence had a belief which was not necessarily false, but different to the child's own belief. Finally the child was asked "Where will Sam look for the dog, in the garden or in the house?" To pass the task the child had to understand that Sam would act based on his own belief rather than the child's belief. Children were scored as either passing or failing the task.

The "not own desire" task (Wellman & Woolley, 1990; appendix E) was similar to the not own belief task. This time the child was introduced to Rosie and told that at Rosie's school the children had the choice to play with sand in the sandpit or puzzles in the classroom. The first question asked: "If that was your school, where would you choose to play, in the sandpit or in the classroom?" Again, the experimenter then informed the child that Rosie wanted to play in the opposite location to the child's preference, and asked, "Where will Rosie play, in the sandpit or in the classroom?" Passing this task reflected the child's understanding that Rosie would act based on her own desire and not that of the child's. Again, a dichotomous "pass" or "fail" scoring system was implemented.

Inhibitory Control Tasks

The following tasks required the child to inhibit a prepotent or dominant response in order to carry out the desired action.

The first task was the Day/Night task (see appendix E; Gerstatd, Hong & Diamond, 1994). The child was presented with a series of cards depicting either a sun or moon and stars, and the task was to say "day" in response to the moon and stars pictures and "night" in response to the sun pictures. This required the child to suppress the prepotent response which is to say "day" to the sun cards and "night" to the moon and stars cards. Following the procedure adopted by Carlson & Moses (2001), the experimenter first established that the cards were associated with "day" and "night" for each child. Children were then presented with two training trials in which they were given feedback (repeated where necessary if the child failed the initial training trials) prior to being scored on experimental trials in order to ensure that they sufficiently understood the task before participating. This was to ensure that any mistakes were more likely to be due to deficits in inhibitory control rather than misunderstanding the rules of the task. Children were rated as successful on this task if they responded correctly to 14 of the 16 pictures in the experimental trials (without feedback). 16 trials were chosen to be consistent with other studies (e.g. Carlson & Moses, 2001), whilst the threshold of 14 was chosen to allow for a small margin of error whilst ensuring that a child could not pass by chance (e.g. by saying "night" in response to all cards and thus scoring 8 out of 16 trials correctly without demonstrating any discrimination between the pictures). This task was scored dichotomously into "pass" or "fail" categories.

The second task, Luria's handgame (see appendix E), was originally designed for use with patients with frontal lobe damage (Luria, Pribram & Homskaya, 1964), but has since been used to determine inhibitory control functioning in pre-school children (Hughes et al, 1998). During the first few trials, in order to set up a prepotent response, the experimenter instructed the child to make a fist shape in response to a fist shape by the experimenter and point a finger when the experimenter pointed a finger. Once the child had habituated to this rule over 3 training trials, the experimenter informed them that the new rule was to produce the opposite shape to that given by the experimenter, i.e. show a fist in response to a finger and a finger in response to a fist. The task therefore required the child to inhibit the initial "imitation" response in order to carry out the new "conflict" response. Before experimental trials were conducted the child had to respond correctly to 4 consecutive practice trials. Consistent with the number of trials used in Hughes et al's (1998) study, 10 experimental trials were conducted, and consistent with the rules used for the threshold on the Day/Night task, children who responded correctly to at least 8 of the 10 test trials were rated as successful. A correct response was coded as a spontaneous correct response or self-corrected response without prompting. As with the Day/Night task, children's scores reflected a categorical "pass" or "fail" distinction.

2.2.6 Missing data

For each child in the study there were 13 potential data points obtained, including 2 parent questionnaires, 2 teacher questionnaires and 9 measures collected during direct child testing. For various reasons complete data was not collected on every child. Child data might not be obtained for example if the child did not speak sufficient English to be tested on all tasks. Some parents signed the consent form and then failed to return the rest of the questionnaires and hence in some cases no parent data were obtained. Nursery staff for various reasons did not return every questionnaire in time, and some questionnaires were returned incomplete. In cases where a questionnaire was not complete, a pro-rating system was used whereby scores on missing items were estimated on the basis of other completed items loading onto the same scale. A rule was assigned to each questionnaire with regard to how many items on each scale were permitted to be missing in order for pro-rated scores to be calculated. For the SDQ the rule was for no more than 1 item to be missing on any given scale, and for no more than 2 scales to have missing data. For the SSRS 2 missing items were permitted on each scale provided that no more than 2 scales had missing data. This was with the exception of the "co-operation" scale on the teacher version of the SSRS, on which 3 missing items were permitted since many teachers commented on the inappropriateness of many of the items for pre-school children (e.g. "produces correct schoolwork"), and consequently there were more missing items on this particular scale. In cases whereby there was an excess of missing data exceeding that permitted by the rules above, the questionnaire was considered void since pro-rated scores could not be reliably calculated. In the results section, Ns for each measure in a given analysis are reported in the tables. For the reasons stated above, the Ns were often different for different measures.

2.2.7 Analyses

A series of Oneway ANOVAs were computed. First of all the "at risk" and "low risk" groups were compared (with "risk" status as the independent variable) with regard to the following risk factors (entered as dependent variables): Non-verbal IQ (BAS), verbal ability (BPVS), theory of mind (composite score), inhibitory control (composite score), parent-rated social skills (standardised score of SSRS), teacher-rated social skills (standardised score of SSRS), parent-rated hyperactivity (hyperactivity sub-scale of SDQ), teacher-rated hyperactivity (hyperactivity sub-scale of SDQ) and experimenter-rated hyperactivity (total score of HBRS). Second, the "situational" and "pervasive groups" were compared on the same risk factors. Finally, boys and girls within the "at risk" group were compared with regard to the same risk factors. This method of analysis was chosen in favour of an interaction analysis for several reasons. Firstly, we were interested in focusing on gender differences within the "at risk" group specifically, in order to determine the factors associated with early risk for conduct in boys relative to girls, regardless of whether the gender differences were also present in the "low risk" group. With interaction analyses, it would have been possible to have a significant interaction yet no significant difference between boys and girls in the "at risk" group specifically. Similarly, it would be possible to have no significant interaction effect despite a significant difference within the "at risk" group. Interaction analyses would therefore be misleading.

Secondly, dimensional analyses in chapter 7 of this thesis, are concerned with gender differences more generally across the whole sample, and thus the extent to which gender differences for the categorical analyses were consistent with gender differences in the dimensional analyses will be explored in chapter 7.

ANCOVAs were also computed, firstly co-varying for non-verbal ability and verbal ability, and secondly a separate ANCOVA co-varying for hyperactivity (parent, teacher and experimenter-rated hyperactivity entered together as covariates). The metric used for interpreting the magnitude of effect sizes shall be the following, recommended by Cohen (1988): Lower than 0.5 denotes a small effect size, between 0.5 and 0.8 equates to a moderate effect size, and 0.8 and above refers to a large effect size.

2.2.8 Methodological and statistical issues

With the sample sizes available for each of the above analyses, it is possible to calculate post-hoc the effect sizes that we had 80% power to detect with alpha set at 0.05. In our "at risk" versus "low risk" comparisons, N=48 in the "low risk" group and N=72 in the "at risk" group. In order to detect medium effect sizes (of between 0.5 and 0.8; Cohen, 1988) we would have required at least 64 participants in each group. Thus we only had sufficient power to detect large effect sizes in these analyses (i.e. 0.8 and above; Cohen, 1988), with a required sample size of at least N=26 participants in each group (Cohen, 1988). With sample sizes of N=30 for boys and N=42 for girls in the gender difference analyses, we also had power to detect large effect sizes.

It is possible, therefore, that with the sample sizes in these analyses we may not have had sufficient power to detect smaller significant differences between the groups. Moreover, in the situational versus pervasive analyses, where N=12 in the pervasive group, our statistical power is not sufficient to detect even large effect sizes, and hence the results should be interpreted tentatively in light of the small groups. This issue is particularly applicable to the data presented in the later follow-up chapters in which sample sizes are even smaller due to drop-out over time.

The next issue of pertinence in this and subsequent chapters is that of the multiple tests of significance which are conducted in using a series of oneway ANOVAs to analyse group differences.

Conducting numerous tests of significance increases the chances of making a type 1 error (i.e. finding a "false positive", or erroneously identifying a significant difference where in fact there is no significant difference). This is due to the fact that in setting alpha at 0.05 there is a 5% chance in each separate analysis of finding a significant difference by chance. Thus, the more analyses conducted, the greater the likelihood that false positives will be identified. There are a number of ways of addressing this issue. One is to calculate a Bonferroni correction post-hoc to take account of the multiple tests of significance. Another is to conduct a MANOVA (Multiple analysis of variance), which combines all the separate analyses to yield both an overall calculation of difference between the groups for all of the dependent variables combined, and for each dependent variable individually. Whilst the latter calculation provides the same set of results as conducting separate Univariate ANOVAs, the MANOVA protects against the effects of multiple comparisons. Further, a discriminant function analysis would provide a similar calculation.

Since the MANOVA calculation removes cases with missing data on any of the variables included in the analysis, this is a problematic method for our data set in which missing data would lead to a large number of cases being excluded from the analyses. Therefore we considered the Bonferroni correction the most appropriate method for addressing multiple tests of significance. Using a Bonferroni correction, the significance level of 0.05 should be divided by the number of dependent variables in the analysis. By this rule, we would need to divide 0.05 by 9, yielding a significance level of 0.005. Thus, in the following analyses presented in this chapter, one should be cautious in interpreting significant results set at $p<0.05$. Highly significant differences between the groups at $p<0.001$ are highlighted in the tables (***), and these are the most robust differences which would withstand the effects of multiple comparisons. Smaller differences could be attributable to this phenomenon and thus results should be considered tentatively.

The third point to note is the extent to which our composite scores (ToM, IC and the Wellman and False Belief composites) were normally distributed and hence were appropriate for analysis with parametric statistics. Using SPSS to calculate skewness and kurtosis (for which scores of between -1 and +1 can be taken as evidence of normality of distribution), we concluded that the data were normally distributed across the sample (ToM composite: skewness = .132, kurtosis = -.831; IC composite: skewness = .667, kurtosis = -.947; Wellman composite: skewness = -.559, kurtosis = -.955; False Belief composite: skewness = .736, kurtosis = -.893).

2.3 Results

2.3.1 Associations between cognitive measures and formation of composite variables

Tables 2.1 and 2.2 show the inter-correlations between the individual theory of mind and inhibitory control tasks. It is clear from table 2.1 that there was substantial inter-correlation between the theory of mind measures, with all except one correlation (Sally-Anne and Not Own Desire) significant at the $p<0.001$ level of significance. The significant correlations were all small in size, ranging from R=.25 to R=.32 and remained significant even when controlling for the effects of the shared associations with non-verbal IQ and verbal ability of the tasks. Since the theory of mind tasks have dichotomous "pass/ fail" scores, Spearman's RHO correlations were computed. However, partial correlations can only be calculated on SPSS using Pearson's correlation coefficients, thus the partial correlations reflect Pearson's correlation coefficients. Consequently, a "theory of mind" composite variable was formed, made up of the sum of all four of the theory of mind tasks. Thus the scores on the composite variable could range from 0 (failing all four tasks) through to 4 (passing all four tasks).

Table 2.1: Spearman's RHO correlations between individual theory of mind tasks *(and partialled for non-verbal IQ and verbal ability)*: Whole group

Task	Sally-Anne	Smarties	Not own belief
Smarties	.32*** *(.28***)* N=194		
Not own belief	.27*** *(.22**)* N=200	.31*** *(.26***)* N=192	
Not own desire	.10 *(.06)* N=200	.25*** *(.21**)* N=192	.30*** *(.26***)* N=200

*p<0.05; **p<0.01; ***p<0.001

Due to the non-significant association between Sally-Anne and Not Own Desire, and the fact that the two Wellman tasks were designed to tap earlier emerging theory of mind abilities, two further sub-composites were also formed enabling developmental trends in theory of mind task performance to be analysed. Thus the "Wellman" composite was formed from the sum of the Not own belief and Not own desire tasks, and the "false belief" composite was formed from the Sally-Anne and Smarties tasks. Scores on both of these composites could range from 0 to 2 depending on the number of tasks passed.

Table 2.2 shows the modest significant (R=.34, p<0.001) Spearman's RHO correlation between the Day/Night task and Luria's hand game (both dichotomous "pass/fail" scores), which remained significant even when the shared associations with non-verbal IQ and verbal ability were partialled out. Again, the partial correlations were calculated using Pearson's correlation coefficients. Given the modest association between the two tasks, they were combined to form an "inhibitory control" composite variable of which scores could range from 0 to 2 reflecting the child's performance on both tasks.

Table 2.2: Spearman's RHO correlations between individual inhibitory control tasks *(and partialled for non-verbal IQ and verbal ability)*: Whole group

Task	Luria's hand game
Day/Night	.34*** *(.29***)* N=199

*p<0.05; **p<0.01; ***p<0.001

Summary of results: *The theory of mind tasks were moderately inter-correlated, therefore a "theory of mind" composite was created by summing together all the theory of mind tasks. In addition, two sub-composites were made up of the tasks measuring the earlier emerging theory of mind skills ("Wellman" composite) and later-emerging theory of mind skills ("false belief" composite). The 2 inhibitory control tasks were also moderately correlated and therefore merged to form the "inhibitory control" composite.*

2.3.2 Risk factor profiles of children "at risk" for conduct problems versus "low risk" children

Aims and hypotheses: *"At risk" children will differ from "low risk" children in that they will have lower non-verbal IQs, poorer verbal ability, poorer parent and teacher rated social skills and higher levels of parent, teacher and experimenter-rated hyperactivity. The study also sought to establish whether previous findings in the literature pertaining to impaired ToM and IC competencies in older children with conduct problems could be extended to this younger sample.*

Tables 2.3 and 2.4 detail the mean scores of the "at risk" children compared with the "low risk" children on all of the above risk factors. In general, the "at risk" group presented with a poorer profile across all risk factors than the "low risk" group, although not all differences were significant.

Table 2.3 details the group differences on the cognitive risk factors. With regard to non-verbal IQ, the mean score for the "low risk" group was 95.42, in the middle of the population average range (referring to a mean score of 100 and a standard deviation of 15). The "at risk" group's mean score was 89.49, almost half a standard deviation below the "low risk" group, and whilst still within the population average range, towards the lower end. This difference approached significance when an ANOVA was calculated ($F (1,114)= 3.088$, $p=0.082$, n.s.). However, once the influence of verbal ability was covaried for, the differences no longer approached significance. The covariate effect for verbal ability was $F (1, 113)= 44.68$, $p<0.001$. When hyperactivity was covaried for, the group differences also fell below significance ($F (1, 99) = 0.06$, n.s.), although the covariate effects for parent, teacher and experimenter-rated hyperactivity separately were not statistically significant.

As hypothesised, there was a significant difference between the "at risk" and "low risk" groups with regard to mean scores measuring verbal ability ($F (1, 112) = 16.47$, $p<0.001$). Again, the mean score of the "low risk" group was in the middle of the average range (100.28), whilst the "at risk" group were almost a standard deviation below (86.33). This difference remained even when controlling for the influence of non-verbal IQ ($F (1, 113) = 12.56$, $p<0.001$). The covariate effect for non-verbal IQ was significant ($F (1,113)= 44.68$, $p<0.001$). The group differences also remained significant when hyperactivity was co-varied for, suggesting that the relative deficit in verbal ability in the "at risk" group compared to the "low risk" group was not due to the fact that they had higher levels of hyperactivity (F (1, 97) = 4.08, p<0.05). Covariate effects for parent, teacher and experimenter-rated hyperactivity were not significant.

No significant differences were found between the two groups with regard to performance on theory of mind or inhibitory control tasks (F (1, 109) = 0.80, n.s; F (1, 109) = 2.09, n.s.). When the analyses were repeated with the Wellman and false belief composites of theory of mind, still no differences emerged.

Table 2.3: Mean scores (standard deviations) on cognitive risk factors: "At risk" versus "low risk" groups

	"Low risk" group (N=48)	"At risk" group (N=72)				
Risk factor	Mean (SD)	Mean (SD)	Effect size	Significant difference?	*Covaried for NVIQ and verbal ability*	*Covaried for hyp*
NVIQ◊	95.42 (17.59) N=48	89.49 (18.12) N=68	0.33	p = 0.082	*n.s.*	*n.s.*
Verbal ability (BPVS) ◊◊	100.28 (18.20) N=47	86.33 (17.96) N=67	0.72	***	***	*
ToM	2.02 (1.24) N=48	1.81 (1.19) N=64)	0.17	n.s.	*n.s.*	*n.s.*
IC	0.70 (0.72) N=47	0.50 (0.74) N=64	0.27	n.s.	*n.s.*	*n.s.*

*p<0.05; **p<0.01; ***p<0.001
◊Only covaried for verbal ability; ◊◊Only covaried for non-verbal IQ

Table 2.4 shows the mean scores for both the "at risk" and the "low risk" groups on the behavioural risk factors. With regard to social skills, both parent- and teacher-rated social skills were significantly poorer in the "at risk" group than the "low risk" group (F (1, 115) = 14.83, p<0.001; F (1, 86) = 18.09, p<0.001). In terms of the mean scores on these standardised measures, the "low risk" group scored within the population average range on both parent (106.36) and teacher (100.23) ratings. The "at risk" group were also within the population average range with regard to parent-rated social skills (94.87), although the mean score was just over two-thirds of a standard deviation below the "low risk" group. On the teacher rating the "at risk" group scored a standard deviation below the "low risk" group, at the lower end of the population average range (86.78). These differences remained significant even when the effects of non-verbal IQ and verbal ability were covaried ($F(1, 110) = 9.85$, $p<0.01$; $F(1, 84) = 7.56$, $p<0.05$). The covariate effects for non-verbal IQ and verbal ability were not significant for parent-rated social skills or teacher-rated social skills. Both parent and teacher-rated social skills remained significantly poorer in the "at risk" group relative to the "low risk" group even when hyperactivity was covaried for, indicating that the group differences could not be explained by co-morbid hyperactivity in the "at risk" group (Parent-rated social skills: $F(1, 99) = 4.37$, $p<0.05$; Teacher-rated social skills: $F(1, 82) = 5.49$, $p<0.05$). Only the covariate effect for parent-rated hyperactivity was significant with regard to parent-rated social skills ($F(1, 99) = 9.00$, $p<0.01$), whilst only the covariate effect for teacher-rated hyperactivity was significant with regard to teacher-rated social skills ($F(1, 82) = 12.85$, $p<0.001$), although the effect parent-rated hyperactivity approached significance ($F(1, 82) = 3.83$, $p=0.054$, n.s.).

Finally, the "at risk" and "low risk" groups were compared with regard to hyperactivity rated by parents, teachers and an experimenter. The "at risk" group displayed significantly higher levels of parent and teacher-rated hyperactivity than the "low risk" group ($F(1, 116) = 17.31$, $p<0.001$; $F(1, 104) = 17.57$, $p<0.001$). The mean score of 2.21 (out of a maximum score of 10) on the parent hyperactivity sub-scale of the SDQ in the "low risk" group corresponds to a score above the population 20^{th} percentile for boys and 30^{th} percentile for girls. The mean score of 3.90 in the "at risk" group on the other hand corresponds to a score above the population 45^{th} percentile for boys and 60^{th} percentile for girls. Similarly, the mean score of 2.04 on the teacher-rated hyperactivity sub-scale in the "low risk" group reflects a score above the population 30^{th} percentile for boys and 50^{th} percentile for girls, compared with the mean score of 4.02 in the "at risk" group, reflecting a score above the population 55^{th} percentile in boys and 75^{th} percentile in girls. Clearly for most of these ratings the "at risk" children were scoring above the population 50^{th} centile with regard to hyperactivity. Group differences remained with regard to both parent and teacher-rated hyperactivity, even after controlling for verbal and non-verbal ability ($F(1, 111) = 9.91$, $p<0.01$; $F(1, 99) = 8.51$, $p<0.01$), thus the "at risk" group were not more hyperactive than the "low risk" group purely because they had lower cognitive ability. Covariate effects of non-verbal and verbal ability were not significant for parent-rated or teacher-rated hyperactivity.

With regard to the experimenter ratings of hyperactivity (using the HBRS), the "at risk" group also presented with significantly higher levels of hyperactivity relative to the "low risk" group (F (1, 116) = 4.50, p<0.05). The "at risk" group had a mean score of 12.12 on the HBRS, compared with 10.05 in the no conduct problems group. This difference was no longer significant when non-verbal IQ and verbal ability were covaried (F (1, 113)= 0.52, n.s.). A significant covariate effect for non-verbal IQ emerged (F (1, 113)= 5.32, p<0.05), but not for verbal ability (F (1, 113)= 1.44, n.s.).

Table 2.4: Mean scores (standard deviations) on behavioural risk factors: "At risk" versus "low risk" groups

	"Low risk" group (N=48)	"At risk" group (N=72)				
Risk factor	Mean (SD)	Mean (SD)	Effect size	Significant difference?	*Covaried for NVIQ and verbal ability*	*Covaried for hyp*
Parent-rated social skills	106.36 (13.54) N=47	94.87 (17.18) N=70	0.69	***	**	*
Teacher-rated social skills	100.23 (13.43) N=43	86.78 (16.06) N=45	0.83	***	**	*
Parent-rated hyp	2.21 (1.65) N=48	3.90 (2.46) N=70	0.73	***	**	*N/A*
Teacher-rated hyp	2.04 (2.13) N=48	4.02 (2.63) N=58	0.76	***	**	*N/A*
Exptr-rated hyp	10.04 (4.41) N=48	12.29 (6.35) N=69	0.39	*	*n.s.*	*N/A*

*p<0.05; **p<0.01; ***p<0.001

Summary of results: *Consistent with hypotheses, there emerged a tendency towards lower non-verbal IQ in the "at risk" group compared with the "low risk" group, and significantly poorer verbal ability. The group difference with regard to verbal ability was not attributable to poorer intellectual functioning or higher levels of hyperactivity in the "at risk" group. Children in the "at risk" group also displayed significantly poorer social skills than children in the "low risk" group, independently of the effects of cognitive ability and hyperactivity, both according to parents and teachers. Further, significantly higher levels of hyperactivity as rated by parents, teachers and experimenters differentiated the "at risk" from the "low risk" group. Parent and teacher-rated hyperactivity continued to be significantly higher in the "at risk" group even when non-verbal and verbal ability were covaried for. There emerged no impairment on tasks measuring theory of mind and inhibitory control competencies in the "at risk" group compared with the "low risk" group.*

2.3.3 Risk factor profiles of children with "pervasive" risk for conduct problems versus children with "situational" risk for conduct problems

Aims and hypotheses: *Children with pervasive risk are expected to display greater levels of impairment in their risk factor profiles than children with situational risk. An aim is to determine whether any specific risk factors most strongly characterise the pervasive group and differentiate them from the situational group.*

Tables 2.5 and 2.6 present the mean scores on the risk factors of the children with situational versus pervasive risk. In line with predictions, the pervasive group performed poorly on all tasks compared with children with situational conduct problems, although not all differences were statistically significant.

Table 2.5 details the cognitive risk factors. No significant group differences emerged with regard to non-verbal ability, theory of mind or inhibitory control. However, there was a significant group difference with regard to verbal ability (F (1, 66) = 4.50, $p<0.05$). Whereas the mean score of the situational group was within the lower end of the average range (88.23), the mean score of children in the pervasive group was almost a standard deviation below the situational group, in the borderline learning disability range (75.50). This difference still showed a non-significant trend in the direction of poorer verbal ability in the pervasive group even when controlling for the effect of non-verbal IQ (F

(1, 66) = 3.48, p=0.067, n.s.). The covariate effect for non-verbal IQ was significant (F (1, 66)= 25.29, p<0.001). However, when controlling for hyperactivity the group differences with regard to verbal ability no longer reached significance (F (1, 50) = 0.94, n.s.), and whilst none of the individual covariate effects of hyperactivity were significant separately (parent, teacher and experimenter), taken together the results suggest that higher levels of hyperactivity in the pervasive group could account for their relative deficit in verbal ability compared to the situational group.

Table 2.5: Mean scores (standard deviations) on cognitive risk factors: Situational versus pervasive conduct problems within "at risk" group

	Situational (N=60)	Pervasive (N=12)				
Risk factor	Mean (SD)	Mean (SD)	Effect size	Significant difference?	*Covaried for NVIQ and verbal ability*	*Covaried for hyp*
NVIQ◊	90.36 (17.26) N=58	84.40 (22.88) N=10	0.33	n.s.	*n.s.*	*n.s.*
Verbal ability (BPVS) ◊◊	88.23 (18.18) N=57	75.50 (12.50) N=10	0.71	*	*p = 0.067*	*n.s.*
ToM	1.91 (1.21) N=55	1.22 (0.97) N=9	0.58	n.s.	*n.s.*	*n.s.*
IC	0.51 (0.74) N=55	0.44 (0.73) N=9	0.10	n.s.	*n.s.*	*n.s.*

*p<0.05; **p<0.01; ***p<0.001
◊Only covaried for verbal ability; ◊◊Only covaried for non-verbal IQ

Both parent- and teacher-rated social skills also showed impairment in the pervasive group relative to the situational group (see table 2.6), with teacher-rated social skills being significantly poorer in the pervasive group (F (1, 43) = 10.79, p<0.01), and parent-rated social skills showing a non-significant trend in the same direction (F (1, 68) = 3.95, p=0.051, n.s.). Teachers rated the social skills of the situational group as being within the population average range (mean score = 90.33). In contrast, the pervasive group were rated by teachers as bordering on learning disability range, more than a standard deviation below the situational group (mean score 72.56). Differences according to parent ratings of social skills were less marked, with the situational group in the mid-average range (96.69) and the pervasive group two-thirds of a standard deviation below, at the lower end of the population average range (86.08).

When the effects of non-verbal IQ and verbal ability were covaried for, the group differences with regard to parent-rated social skills now reached significance ($F(1, 64) = 4.40$, $p<0.05$), and the significant group differences with regard to teacher-rated social skills remained so ($F(1, 41) = 5.75$, $p<0.05$). No significant covariate effects emerged for non-verbal IQ and verbal ability with regard to parent-rated social skills or teacher-rated social skills. Group differences in social skills were thus not attributable to poorer cognitive ability in the pervasive group. Nevertheless, they may have been attributable to higher levels of hyperactivity in the pervasive group, since covarying for hyperactivity resulted in the group differences falling below significance (parent-rated social skills: $F(1, 52) = 2.47$, n.s; teacher-rated social skills: $F(1, 39) = 2.27$, n.s.). The only significant individual covariate effect was that of parent-rated hyperactivity on the group differences with regard to parent-rated social skills ($F(1, 52) = 12.24$, $p<0.001$).

Finally, table 2.6 shows that the pervasive group presented with significantly higher levels of hyperactivity according to both parents and teachers than the situational group (parent-rated hyperactivity: $F(1, 68) = 4.00$, $p<0.05$; teacher-rated hyperactivity: $F(1, 56) = 13.30$, $p<0.001$). Parent ratings of hyperactivity in the situational group had a mean score of 3.64, equivalent to a score of above the population 45th percentile for boys and above the population 60th percentile for girls. In contrast, in the pervasive group, the mean score of 5.17 corresponds to a score above the population 60th percentile for boys and 74th percentile for girls. Even more marked group differences emerged with regard to teacher-rated hyperactivity, with a mean score of 3.43 in the situational group corresponding to a score above the population 40th percentile for boys and 64th percentile for girls, compared with a mean score in the pervasive group of 6.25, reflecting a score above the population 73rd percentile for boys and 90th percentile for girls. Controlling for non-verbal and verbal ability did not lower the group differences with regard to teacher-rated hyperactivity ($F(1, 52) = 18.16$, $p<0.001$), with no significant covariate effects. Whilst there were also no significant covariate effects for either non-verbal IQ or verbal ability with regard to parent-rated hyperactivity, the group differences no longer reached significance when controlling for these aspects of cognition, suggesting that perhaps they account for some of the variance in parent-rated hyperactivity between the 2 groups (F (1, 64) = 1.70, n.s.). No significant differences emerged between the two groups with regard to experimenter-rated hyperactivity.

Table 2.6: Mean scores (standard deviations) on behavioural risk factors: Situational versus pervasive conduct problems within "at risk" group

	"Situational" (N=60)	"Pervasive" (N=12)				
Risk factor	Mean (SD)	Mean (SD)	Effect size	Significant difference?	*Covaried for NVIQ and verbal ability*	*Covaried for hyp*
Parent-rated social skills	96.69 (16.90) N=58	86.08 (16.43) N=12	0.62	p=0.051	*	*n.s.*
Teacher-rated social skills	90.33 (14.93) N=36	72.56 (12.56) N=9	1.11	**	*	*n.s.*
Parent-rated hyp	3.64 (2.49) N=58	5.17 (1.95) N=12	0.62	*	*n.s.*	*N/A*
Teacher-rated hyp	3.43 (2.33) N=46	6.25 (2.60) N=12	1.07	***	***	*N/A*
Exptr-rated hyp	11.78 (6.11) N=59	15.30 (7.23) N=10	0.55	n.s.	*n.s.*	*N/A*

*p<0.05; **p<0.01; ***p<0.001

Summary of results: *Consistent with hypotheses there was evidence to suggest that amongst the "at risk" group, there is a sub-group of children with pervasive risk, whose profiles with regard to verbal ability, social skills and levels of hyperactivity appear to show a higher level of impairment than children with situational risk. No significant differences emerged with regard to non-verbal IQ, theory of mind or inhibitory control competency between the pervasive and situational groups.*

2.3.4 Risk factor profiles of "at risk" boys versus "at risk" girls

Aims and hypotheses: *The proportion of boys and girls in the "at risk" group will be investigated to help address contradictory findings in the literature to date. "At risk" boys with early conduct problems will score relatively poorly on tasks measuring cognitive ability compared with "at risk" girls, and the extent to which this finding is limited to or most strongly applies to verbal or non-verbal cognitive ability will be investigated. It is hypothesised that "at risk" boys will present with poorer parent and teacher rated social skills and higher levels of hyperactivity in relation to "at risk" girls. "At risk" boys and girls shall also be compared on measures of theory of mind and inhibitory control.*

There emerged no significant difference between the proportion of boys and the proportion of girls falling into the "at risk" group compared to the "low risk" or "middle/ excluded" groups (X^2 (2, 218) = 2.16, n.s.). There was also no significant difference in the proportion of boys and girls falling into the "pervasive" group compared to the "low risk", "middle/ excluded", or "situational" groups (X^2 (2, 218) = 4.69, n.s.). The general trend, however, was in the direction of more girls than boys in both the "at risk" group and the "pervasive" group (28% of the boys, N=29 and 38% of the girls, N=42 in the "at risk" group; 3% of the boys, N=3 and 8% of the girls, N=9 in the "pervasive" group). Due to the comparable numbers of boys and girls falling within the various categories of "risk", chi-squared analyses were conducted comparing boys and girls within the "at risk" group across all items of the parent and teacher SDQ conduct problems sub-scales, in order to determine whether separate aspects of conduct problem behaviours characterised "at risk" boys and girls. The only item on which boys and girls differed significantly was the parent SDQ item: "Often fights with other children or bullies them" (X^2 (2, 71) = 9.87, $p<0.01$). Girls were significantly more likely than boys to receive a rating of "not true" in response to this item, indicating that whilst equally represented within the "at risk" group, girls were less involved in physical fighting or bullying than boys according to parents.

Tables 2.7 and 2.8 illustrate the findings from the main analyses with regard to gender differences across the risk factor profiles amongst the "at risk" group. Consistent with predictions, boys' scores on 10 of the 11 risk factors considered were poorer than the girls'. However, the favourable performance of the girls over the boys was not significant for all measures.

A non-significant trend was found with regard to non-verbal IQ ($F (1, 66) = 3.69$, $p=0.059$, n.s.), with the mean score for girls within the population average range (92.95) and the mean score for boys half a standard deviation below that of girls, and falling just below the population average range (84.54). The magnitude of the difference was only small, with an effect size of 0.46. This difference continued to approach significance even when the effect of verbal ability was covaried for in the analyses ($F (1, 66) = 3.52$, $p=0.065$, n.s.). The covariate effect for verbal ability was significant ($F (1, 66)= 26.58$, $p<0.001$). Controlling for hyperactivity resulted in the group differences no longer approaching significance ($F (1, 51) = 0.55$, n.s.), indicating that whilst the covariate effects for each of the individual ratings of hyperactivity were not significant, a proportion of the variance differentiating the boys and girls with regard to non-verbal IQ could have been accounted for by boys' elevated levels of hyperactivity. No significant gender differences emerged with regard to verbal ability, for which both "at risk" boys and "at risk" girls achieved mean scores at the lower end of the population average range (see table 2.7).

Inhibitory control showed no significant gender difference (table 2.7), whereas there was a non-significant trend with regard to theory of mind performance ($F (1, 62) = 3.96$, $p=0.051$, n.s.). Girls showed a non-significant tendency towards performing comparatively better than boys on tasks measuring theory of mind ability. This difference no longer approached significance on controlling for the effects of non-verbal IQ and verbal ability ($F (1, 63) = 2.27$, n.s; with a significant covariate effect for verbal ability: $F (1, 63)= 4.05$, $p<0.05$). However, when the theory of mind composite was broken down into its constituent components, it emerged that girls significantly out-performed boys on the Wellman composite made up of the tasks tapping earlier-emerging theory of mind competency ($F (1, 62) = 4.81$, $p<0.05$). This difference still approached significance even when covarying for non-verbal IQ and verbal ability ($F (1,63) = 3.19$, $p=0.079$, n.s.). Covariate effects for non-verbal IQ and verbal ability were not significant. With regard to the false belief theory of mind composite, which taps later-emerging theory of mind competency, a gender difference in the same direction approached significance ($F (1,61) = 3.37$, $p=0.071$, n.s.), but the effect was not maintained when non-verbal IQ and verbal ability were covaried for. Covariate effects were not significant for either non-verbal IQ or verbal ability.

It should be noted however that all gender differences with regard to the theory of mind composite and the Wellman and false belief composites failed to reach significance after controlling for hyperactivity (ToM: $F (1, 47) = 0.40$, n.s; Wellman: $F (1, 48) = 1.05$, n.s; False belief: $F (1, 47) = 0.51$, n.s.). The only significant covariate effect for hyperactivity was with regard to experimenter-rated hyperactivity within the theory of mind composite analysis ($F(1, 47) = 5.48$, $p<0.05$). Thus, higher levels of hyperactivity in the "at risk" boys could account for their poorer performance on the theory of mind tasks compared with the "at risk" girls.

Table 2.7: Mean scores (standard deviations) on cognitive risk factors within "at risk" group: Boys Vs. girls

	Boys (N=30)	Girls (N=42)				
Risk factor	Mean (SD)	Mean (SD)	Effect size	Significant difference?	*Covaried for NVIQ and verbal ability*	*Covaried for hyp*
NVIQ◊	84.54 (18.18) N=28	92.95 (17.48) N=40	0.46	p=0.059	*p=0.065*	*n.s.*
Verbal ability (BPVS) ◊◊	84.89 (19.46) N=27	87.30 (17.06) N=40	0.13	n.s.	*n.s.*	*n.s.*
ToM	1.46 (0.95) N=26	2.05 (1.29) N=38	0.49	p=0.051	*n.s.*	*n.s.*
ToM – Wellman composite	1.08 (0.74) N=26	1.47 (0.69) N=38	0.53	*	*p=0.079*	*n.s.*
ToM – False belief composite	0.35 (0.56) N=26	0.68 (0.78) N=37	0.46	p=0.071	*n.s.*	*n.s.*
IC	0.35 (0.63) N=26	0.61 (0.79) N=38	0.35	n.s.	*n.s.*	*n.s.*

*p<0.05; **p<0.01; ***p<0.001
◊Only covaried for verbal ability; ◊◊Only covaried for non-verbal IQ

One further significant difference emerged between boys and girls with early conduct problems (table 2.8). Boys displayed significantly higher levels of experimenter-rated hyperactivity than girls ($F(1, 67) = 8.37$, $p<0.01$), and the difference continued to approach significance even when the effects of non-verbal IQ and verbal ability were covaried for ($F(1, 66) = 3.79$, $p=0.056$, n.s.). The covariate effects of non-verbal IQ and verbal ability were not significant. No significant gender differences with regard to levels parent or teacher-rated hyperactivity emerged.

Table 2.8: Mean scores (standard deviations) on behavioural risk factors within "at risk" group: Boys Vs. girls

	Boys (N=30)	Girls (N=42)				
Risk factor	Mean (SD)	Mean (SD)	Effect size	Significant difference?	*Covaried for NVIQ and verbal ability*	*Covaried for hyp*
Parent-rated social skills	91.90 (16.91) N=30	97.10 (17.25) N=40	0.30	n.s.	*n.s.*	*n.s.*
Teacher-rated social skills	91.16 (16.24) N=19	83.58 (15.45) N=26	0.35	n.s.	*n.s.*	*p=0.074*
Parent-rated hyp	4.20 (2.57) N=30	3.68 (2.39) N=40	0.21	n.s.	*n.s.*	*N/A*
Teacher-rated hyp	4.27 (2.80) N=22	3.86 (2.54) N=36	0.16	n.s.	*n.s.*	*N/A*
Exptr-rated hyp	14.76 (7.25) N=29	10.50 (4.98) N=40	0.67	**	*p=0.056*	*N/A*

*p<0.05; **p<0.01; ***p<0.001

Summary of results: *Boys and girls were equally represented within the "at risk" group. However, the girls showed a non-significant trend towards higher non-verbal IQs than the boys, and performed significantly better than the boys on tasks assessing early-emerging theory of mind competency. Girls also displayed significantly lower levels of experimenter-rated hyperactivity. Not consistent with the hypotheses were the findings that there were no differences between "at risk" boys and girls with regard to verbal ability or social skills. Some evidence suggests that the gender differences with regard to non-verbal ability and theory of mind may have been due to the higher levels of hyperactivity in the boys.*

2.4 Discussion

2.4.1 Proportion of children in the "at risk" group

Children fell into the "at risk" group if they received a rating on the SDQ conduct problems sub-scale, from either a parent or a teacher (or both), which placed them above the population 10th percentile according to Meltzer et al's (2000) norms, which were based on a representative sample of 5-11 year old children. We would therefore expect that around 10% of our sample would fall into the "at risk" group, which would predict that the "at risk" group would consist of approximately 22 children. In fact, 72 children fell into the "at risk" group (33%). This finding could reflect one of two possibilities. Either our sample are a particularly "high risk" sample in which a higher degree of pathology is detectable than in the general population, or the fact that we used norms based on 5-11-year-olds to categorise "risk" in 3-year-olds could account for the findings.

The 5-11 year old norms were used in the absence of normative data for 3-year-olds (Goodman, personal communication, 2002). It is possible therefore that the "true" cut-off points for detecting risk in 3-year-olds would be higher than those of 5-11-year-olds, and thus by using the norms for the older children we would, by default, identify a number of "false positives" who in fact were displaying appropriate behaviour for a 3-year-old. However, the fact that, as discussed below, the 5-11-year-old cut-off point identified a group of children distinguishable from their low risk peers with regard to impairment across a number of other areas of functioning, suggests that we have in fact identified a group of children for which there is substantial evidence of risk. Further, other studies pertaining to behaviour in pre-school children below the age of Meltzer et al's (2000) sample, have also used the 5-11 year old norms as a basis for selecting risk, and have demonstrated significant impairment in children selected using this threshold (e.g. Hughes et al, 1998).

2.4.2 Risk factor profiles of "at risk" versus "low risk" groups

- **Verbal ability and non-verbal IQ**

It emerged that with regard to the tasks measuring non-verbal IQ, there was a non-significant trend towards the "low risk" children achieving significantly higher scores than the "at risk" children. Both mean scores were in the normal range (referring to population norms of a mean score of 100 and a standard deviation of 15), although the mean score of the "at risk" group (89.49) was almost a population standard deviation below the mean score for the "low risk" group (95.42). The effect size of 0.33 was small however, and indeed once the shared variance with verbal ability was taken into account the difference between the groups no longer approached statistical significance. This suggests that in fact verbal ability differentiated the groups, and that non-verbal ability only appeared to do so by virtue of its close association with verbal ability.

Indeed, the "low risk" group did have significantly higher scores on the measure of verbal ability than the "at risk" group, with a standard deviation difference between the mean scores of the two groups. The mean score of the "low risk" group was in the middle of the population average range (100.28), whilst the mean score of the "at risk" group was at the lower end of the average range (86.33). The effect size of 0.72 was moderate, and the fact that controlling for the shared variance with non-verbal ability and with hyperactivity did not result in the group differences disappearing suggests that the difference truly reflects a specific association between conduct problems and poor verbal ability. Thus, in support of the hypothesis, and consistent with the Waltham Forest Study's findings at age 3 (Richman et al, 1982) and Donnellan et al's (2000) findings, verbal ability emerged as more important than non-verbal IQ in differentiating children "at risk" for conduct problems from "low risk" children.

How might these findings relate to the hypothesised theories regarding the possible causal mechanisms behind the association between cognitive ability and conduct problems? If both cognitive deficits and conduct problems are present as early as age 3, one might hypothesise that behaviour would not yet have had sufficient time to influence the acquisition of knowledge and performance given the fact that the children are not yet in full-time education. Thus, the "low IQ is a cause" or "low IQ is a marker" accounts (Goodman et al, 1995) seem to be the most likely explanations. It is hypothesised, given the implications of early onset conduct problems which are associated with cognitive deficits (Farrington, 1995), that the children presenting with this profile of impairment are at risk for continued conduct problems beyond the pre-school years. These findings also indicate that studying conduct problems in the pre-school period is unlikely to be a fruitless task in terms of the likelihood of identifying potentially persistent and/or severe conduct problems later in development, given that even at this early stage in development behavioural problems are already associated with impairments in other areas of functioning.

With regard to the finding that verbal ability specifically appears to be the important cognitive impairment in the association with conduct problems, some interesting possibilities are raised. It may be that deficits in the acquisition of language and verbal intelligence are more influential for conduct problems than deficits in non-verbal cognitive ability. Given that language is important for communication and forming relationships, this is perhaps not such a surprising finding. Adhering to the "IQ is a cause" hypothesis, therefore, one tentative explanation might be that having poor verbal skills interferes more with competency in communication than having a low non-verbal IQ and hence is more likely to lead to antisocial behaviour, perhaps as a result of the frustrations arising from difficulties understanding or making oneself understood. Other theorists have highlighted the importance of internal self-talk for regulating behaviour (Luria et al, 1971), suggesting that an impairment in verbal ability could disrupt a person's capacity for self-control. Nevertheless, why such an account should apply more readily to conduct problems than hyperactivity is unclear, since the capacity for self-control and behavioural inhibition has often been suggested as a key deficit underlying hyperactivity (Barkley, 1997).

Adhering to the "IQ is a marker" account, the impact of genetic or environmental risk factors on the acquisition of both verbal and non-verbal cognitive functioning is credible: poor parenting practices or low parental IQ for example might lessen exposure to stimulating interactions and environments, which would make it less likely that a child would develop to their full intellectual potential. However, it is more difficult to conceive of an explanation for a greater impact upon verbal over non-verbal functioning. Why might a genetic propensity or lack of stimulation be more likely to result in verbal deficits? A lack of evidence pertaining to such a concept makes the "IQ is a marker" hypothesis perhaps less tenable than the "IQ is a cause" account.

- **Theory of mind**

No significant differences between "at risk" and "low risk" children in terms of their performance on theory of mind tasks emerged, even when the tasks were grouped separately according to the developmental order at which they are proposed to develop. Delayed and deviant theory of mind development has recently been linked with the presence of "hard to manage" behaviour in 4-year-olds, selected primarily for the presence of high levels of hyperactivity but in 80% of cases also falling above the population 90th percentile cut-off on the SDQ for conduct problems (Hughes et al, 1998). This chapter therefore aimed to determine whether theory of mind delay would be evident as early as age 3 amongst children "at risk" for conduct problems, with the hypothesis that such a presentation would likely place a child at risk for continued conduct problems later in development. This was based on the conjecture that theory of mind competency is positively associated with, amongst other things, school adjustment (Dunn, 1995), positive mother-child interaction styles (Ruffman et al, 1999) and peer acceptance (Slaughter et al, 2002). Difficulties in all of these areas have been implicated in theories pertaining to the development and maintenance of conduct problems (e.g. Patterson, 1982).

In the present study, standard false belief tasks were included in order to track developmental changes in the proportion of children passing the tasks at age 4 compared with age 3. Whilst false belief tasks are typically passed by 4-year-olds (Astington et al, 1988), concepts of "not own belief" and "not own desire" are believed to develop much earlier in development (Wellman & Bartsch, 1988; Wellman & Woolley, 1990). For this reason tasks measuring these proposed earlier-emerging theory of mind competencies were also included in the test battery so that even in the presence of a floor effect for the false belief tasks, differences might still be notable in earlier-emerging mentalising skills.

Despite the fact that understanding that a person can hold beliefs or desires that are *different from one's own* is somewhat different to conceptualising that a person can hold a *false* belief, both sets of tasks tap a child's ability to recognise that a person's beliefs or desires will influence their behaviour. Indeed, the not own belief task was moderately correlated with the false belief tasks indicating that there was sufficient association between the tasks to consider them as a developmental sequence of theory of mind acquisition. However, the not own desire task was not correlated with the false belief tasks, but did correlate significantly with the not own belief task. This was not surprising since the concept of another person holding a desire that is different from one's own could be argued to be the earliest emerging ability of all the mentalising concepts measured by the tasks, consistent with the notion of young children being "simple desire psychologists" before they become "belief-desire psychologists" (Bartsch & Wellman, 1995; Wellman & Woolley, 1990). Thus the not own desire task is arguably the least comparable to the more sophisticated tasks. The fact that the two Wellman tasks were inter-correlated and that as a composite they correlated with the false belief composite was taken as sufficient evidence that these could be considered a developmental set of tasks which measure distinct but related mentalising concepts.

It could be argued that a floor effect was in operation with regard to the results relating to performance on the false belief tasks, since a large number of children may have failed the task due to their developmental level and hence no differences could be detected between the two groups. 54% of the sample failed both false belief tasks, 29% passed one of the tasks, and only 18% passed both. However, this argument could be less clearly levelled at the results pertaining to the "not own belief" and "not own desire" tasks, which should be passed easily by this age. Indeed, the opposite pattern with regard to passing was evident with the Wellman task composite, with 16% failing both tasks, 37% passing one of the tasks, and 48% passing both of the tasks. The results suggest therefore that despite the low scores on the false belief tasks in both the "at risk" and the "low risk" groups, the fact that no differences emerged between the groups with regard to "not own belief" and "not own desire" suggests that rather than a measurement error in which differences could be argued to exist but be un-measurable, it is most likely that developmental differences are not in place at this early age, despite the evidence that they have been demonstrated to emerge as soon as a year later (Hughes et al, 1998). Support was also found for the notion that the concept of desire is understood before the concept of belief (Bartsch & Wellman, 1995). 80% of the sample passed the "not own desire" task, whilst 44% passed the "not own belief" task.

The time period between 3 and 4 years of age seems to be a critical developmental period for the emergence of impairments in mentalising ability in children already presenting with early risk for conduct problems. Adhering to an account implicating conduct problems as causal factors in the onset of impaired or delayed theory of mind development, it could be argued that at 3 years old children "at risk" for conduct problems are unimpaired relative to their peers with regard to understanding others' minds. By the age of 4, however, according to preliminary evidence in the literature (Hughes et al, 1998), one might contest that the cycle of interactions with peers, family and teachers resulting from their behaviour limits their social experiences or at least provides them with skewed experiences, such that the development of theory of mind is delayed or impaired. They have not had the opportunities for developing an understanding of the thoughts, feelings and actions of others because they have had limited positive social interactions due to their antisocial behaviour. Clearly more research in this little-studied field will be necessary to test this hypothesis, but implications from the results reported in this chapter are consistent with such a theory. In chapter 4 of the present study, this hypothesis can be tested when the "at risk" sample are followed up at age 4.

One further point worth noting is the fact that not all theorists agree that conduct problems should necessarily be associated with an impairment in the capacity to mentalise. Sutton et al (1999) for example argued that some forms of antisocial behaviour may in fact require *superior* mentalising skills in order to manipulate and cause distress to others. However, at 3 years old it is unlikely that such sophisticated bullying techniques requiring an in-depth understanding of others' thoughts and feelings would be in operation. Further, there was no evidence in the present study that the "at risk" group demonstrated advanced theory of mind skills compared to the "low risk" group. In fact, the scores were slightly though not significantly lower in the "at risk" group. Finally, Sutton et al's (1999) theory is not supported by studies such as Hughes et al (1998) in which children with conduct problems are generally impaired relative to their peers on tasks measuring theory of mind. Sutton et al's theory requires further replication, and is likely even if replicated to apply to a particular sub-set of older antisocial children.

- **Inhibitory control**

No significant differences in performance on tasks measuring inhibitory control were found between the "at risk" and the "low risk" groups. In fact, both groups performed poorly on the IC tasks. It is well established that deficits in executive functioning, particularly inhibitory control, characterise older individuals with persistent and severe antisocial behaviour (Lynam, 1996; Raine, 2002), and this has been proposed to reflect a frontal lobe deficit which interferes with the capacity to inhibit behaviour, thus resulting in conduct problems in individuals also subject to negative environmental influences (Raine, 2002). Recent research has shown that associations between conduct problems (albeit in conjunction with hyperactivity) and impairments in inhibitory control are evident as early as 4 years old (Hughes et al, 1998). However, other theorists have forewarned that inhibitory control deficits are in fact characteristic of hyperactivity, and merely associated with conduct problems because of the high comorbidity between the two behaviour symptoms (Hill, 2002). An aim for the present chapter was therefore to determine whether children as young as 3 years old showing early risk for conduct problems might already present with impairments in the capacity for inhibitory control.

How might the lack of significant group differences in the present study at age 3 fit with the literature to date? It is possible that IC deficits do underlie the early conduct problems demonstrated by the "at risk" children and that they are impaired relative to the "low risk" children, which would be consistent with Raine's (2002) prefrontal dysfunction theory, but that the differences are simply not measurable due to the tasks available to measure IC competency in children as young as three years old. The findings might, in other words, constitute floor effects on the tasks used but not be indicative of the true IC competency of the children.

A brief discussion of the tasks used to measure IC in this study and our reasons for using them is therefore warranted here. Luria's hand game and the Day/Night task both require the child to inhibit a dominant or pre-potent response in order to carry out the required task. In Luria's hand game the child is habituated to an "imitation" phase of trials in which they are asked to copy a fist or finger hand action by the experimenter. Following the imitation trials, a set of "conflict" trials are administered. The child's task in the conflict trials is to produce the opposite hand action to the one shown by the experimenter. In the Day/Night task the child is required to respond to a picture of a moon and stars by saying the word "day" and to a picture of a sun by saying the word "night".

IC competency is believed to develop in the pre-school years (Welsh & Pennington, 1988), and hence it was anticipated that there may be some potential for floor effects on the IC tasks in this 3-year-old sample. However, it was important to use tasks which could be used across the pre-school period to enable comparability between longitudinal follow-up assessments, and to our knowledge no IC tasks span from the toddler through to the school-age period. Unlike the theory of mind test battery, it was not considered appropriate to use a test of executive functioning designed for use in younger children since no comparable IC task exists for younger children. The "A not B" task is one such task designed for infants (e.g. Diamond, Cruttenden & Neiderman, 1994). The task requires the child to observe a toy being hidden in one of two locations, and then to reach after a short delay to retrieve the toy. Infants from 7 ½ to 12 months typically reach in the correct location on the first trial, but incorrectly reach for the same location on a later trial when the toy is hidden in the other location (Diamond et al, 1994). The task is believed by some researchers to require a certain degree of inhibitory control amongst other skills such as memory (Diamond et al, 1994). However, other researchers have argued that the task taps a child's attentional capacity rather than inhibitory control

(Ruffman & Langman, 2002). With such uncertainty surrounding the cognitive processes involved in passing the A not B task, alongside the fact that it is designed for children much younger than the present sample and might therefore produce ceiling effects, it was not considered a suitable measure of IC in 3-year-olds. Since no alternative age-appropriate tasks are available to reliably assess IC between the ages of 3 and 5, Luria's hand game and the Day/Night task were deemed the most appropriate measures of emerging IC ability in 3-year-olds.

Our results could thus reflect a problem with the tasks in measuring IC competency in 3 year olds. It is possible that, drawing on ideas such as those proposed by Luria et al (1971) with regard to the link between verbal ability and behavioural regulation, that cognitive impairments such as IC do underlie antisocial behaviour, but are not yet demonstrable at 3 years old. Perhaps therefore a "prefrontal dysfunction" (Raine, 2002) or other such cognitive deficit is first expressed via a deficit in verbal ability, such as that found in the present study, and reflects an early expression of a wider cognitive impairment already evident, which later takes the form of a deficit in IC. Our results do not necessarily contradict the notion that IC impairments underlie antisocial behaviour.

An alternative explanation for the results is that IC impairments do not precede or cause conduct problems, but that the association in older children reflects conduct problems preceding and leading to deficits in IC. Indeed, most studies investigating the link between conduct problems and IC are based on older children (Henry & Moffitt, 1997; Lynam, 1996), suggesting that this could be a phenomenon which emerges following a significant period of established conduct problems.

Is it possible that this "period of established conduct problems" could impact upon IC competency as soon as a year later? Hughes et al (1998) did find that her hard to manage children were more likely to fail one of the tasks measuring IC than controls. However, the IC measure in which the differences were demonstrated was the Detour Reaching Box (Hughes & Russell, 1993). The detour-reaching box requires the child to switch between different strategies for retrieving a marble depending on the colour of a light which is illuminated. Hughes et al describe the task as a measure of IC. However, set-shifting or attentional flexibility might as easily be implicated as necessary skills for completing the task. Indeed, no one response set is discernibly dominant in the detour-reaching box task as it is in Luria's hand game or the Day/Night task, and though the child is required to cease one response in favour of another, the responses are interchangeable and aside from order of learning no reason exists for one to be a dominant response. Clearly an element of inhibitory control is required to suppress the previous response, but the over-riding skill required appears to be the flexibility to change from one response set to another and back again in succession.

It seems therefore that the presence of IC deficits in very young children with early risk for conduct problems is at best difficult to establish. This could implicate conduct problems as the first to emerge, suggesting that perhaps an established period of conduct problems eventually impacts upon the ability to inhibit behaviour. Alternatively, models such as Raine's (2002) prefrontal theory might need adjusting to incorporate the earlier-emerging expression of cognitive vulnerability. Thus, perhaps deficits in verbal ability amongst young children with early conduct problems reflect the same underlying cognitive impairment that is later recognisable as a deficit in IC. One further possibility which has yet to be addressed adequately, is the possibility that IC impairments are in fact not associated with conduct problems but relate instead to hyperactivity (Hill, 2002). As mentioned before, Hughes et al's (1998) "hard to manage" group consisted of a group of children above the 90th percentile on the hyperactivity sub-scale of the SDQ, who also happened to be above the cut-off on the conduct problems sub-scale in 80% of cases. The results of this study might thus reflect the association between IC and hyperactivity. Indeed, Berlin and Bohlin (2002) reported that the association between inhibitory control and conduct problems was no longer significant when controlling for the effect of hyperactivity, whereas the association between hyperactivity and IC was independent of the presence of conduct problems. The present chapter cannot address this particular issue, but does suggest that if poor IC is a marker for severe and persistent conduct problems, it is not one which can be easily identified as early as age 3, at least with the measures used in the present study. Chapters 3 and 5 will address the extent to which conduct problems and hyperactivity as dimensions across the whole sample (i.e. not limited to extremely high levels of conduct problems or hyperactivity) are uniquely associated with IC at age 3 and age 4, and this may help ascertain the extent to which conduct problems are associated with IC and whether this association is independent of hyperactivity.

- **Social skills**

Children in the "at risk" group were found to present with significantly poorer social skills than the "low risk" children, according to both parental and teacher reports. These findings remained even when taking into account the shared variance with verbal and non-verbal IQ, and hyperactivity. Thus, impaired cognitive ability and elevated hyperactivity in the "at risk" group were not responsible for the observed differences in social skills ratings of parents and teachers between the two groups. In terms of the strength of the group differences, effect sizes of 0.69 and 0.83 respectively for parent-rated and teacher-rated social skills indicate moderate to large effects. Children in the "low risk" group were in the upper-end of the population average range according to parental ratings of their social skills (mean score 106.36) whereas the "at risk" group were functioning two-thirds of a standard deviation below although still within the average range (mean score 94.87). Similarly, teacher-rated social skills in the "low risk" group were in the middle of the population average range (mean score 100.23) whilst the "at risk" group were rated almost a standard deviation below, at the lower end of the average range (mean score 86.78).

We hypothesised that the "at risk" group would present with significantly poorer social skills than the "low risk" group, based on the conjecture that "life course persistent" individuals (Moffitt, 1993) would be identifiable as early as age 3. Since social skills deficits have been reported to predict later antisocial behaviour (Stevenson & Goodman, 2001), we predicted that deficits in social skills would be present alongside these early-emerging conduct problems. This finding suggests that the social skills problems experienced by older children with conduct problems (Parker & Asher, 1987) which are such a prime target for intervention initiatives (Webster-Stratton, 1991) are present very early in development and associated with conduct problems even in the first few weeks and months of entering nursery. The prognosis for these children might be expected to be poor, given that difficulties are already present in such an important area of functioning alongside the risk for conduct problems.

It is difficult to decipher whether the early conduct problems in the "at risk" group may have caused social skills difficulties or vice-versa, given that the two are present at the same time so early in development. This begs the question of whether the two constructs are in fact the same phenomenon. In other words, could "conduct problems" mean essentially the same thing as "lack of social skills"?. By definition, conduct problems are concerned with behaviour which is deemed "antisocial". Thus, is it surprising that the two difficulties emerge together and are highly correlated? Looking at the individual items on the questionnaires measuring social skills and conduct problems, it is possible to examine this question more closely.

The SSRS "self control" sub-scale does in fact include a number of items which overlap with items on the SDQ "conduct problems" sub-scale which was used to classify the conduct groups. For example, the SDQ conduct problems scale includes an item asking about how often the child has temper tantrums or hot tempers. The SSRS self control scale asks about the child's ability to control their temper in conflict situations with parents, peers and teachers. Another item of overlap is evident in the SDQ conduct item "generally obedient", which seems to be mirrored by the SSRS self control items "follows your instructions" and "follows rules/waits turn in games". Furthermore, the SDQ conduct scale enquires whether the child often fights with or bullies other children, whilst the SSRS self control scale asks whether the child responds appropriately to teasing, hitting or pushing by other children. Nevertheless, there are still other items on the SSRS self control scale which do not have equivalent items on the SDQ conduct scale, and vice-versa. No items on the SSRS self control scale relate to the "spiteful to others" item on the SDQ conduct scale, and other items on the SSRS self control scale are concerned with tone of voice, extent to which the child receives criticism well, and the child's ability to co-operate without prompting, none of which are included on the SDQ conduct scale. Further, there are another two scales of the SSRS teacher version ("assertion" and "co-operation") and three on the SSRS parent version (with the addition of "responsibility"), none of which have equivalent items on the SDQ conduct scale. Analysis of the sub-scales separately (see appendix F) revealed that all but one of the sub-scales were associated with superior ratings for children without conduct problems, and that these results were therefore not limited to the self control sub-scale which overlaps with items on the SDQ conduct problems scale.

Assuming that social skills are in fact a separate construct from conduct problems, and that the significant finding constitutes a true difference in the social skills ratings of children in the "at risk" group versus the "low risk" group, the results offer an interesting implication with regard to the causal relationship between theory of mind and social skills. Adhering to theorists such as Dodge et al (1990) and Happé and Frith (1996), one would expect that if the social skills deficits experienced by children with conduct problems are caused by maladaptive or delayed theory of mind development, the delay or deviance in theory of mind would be evident earlier in development or at least alongside the emergence of social skills problems. However, the opposite finding was apparent in the current data set. There was no difference in theory of mind competency between the children with conduct problems and children without conduct problems, despite the fact that tasks tapping earlier emerging theory of mind abilities were included in the test battery. Social skills ratings on the other hand differed significantly between the two groups, with the "at risk" group rated as having poorer social skills by both parents and teachers than the "low risk" group. Should the findings presented by Hughes et al (1998) be replicated in the present study when the children are 4 years old, and a delay in theory of mind emerges in the "at risk" group relative to the "low risk" group, alongside continuing social skills deficits, then this might be consistent with a hypothesis implicating the causal effects of social skills deficits in theory of mind impairment at least in children with conduct problems.

- **Hyperactivity**

The "at risk" group presented with significantly higher levels of hyperactivity than the "low risk" group, as hypothesised. This effect was evident across all raters, although was most marked with regard to parent and teacher rated hyperactivity (effect sizes 0.73 and 0.76 respectively, reflecting moderate group differences). The mean parent-rated hyperactivity score for the "low risk" group corresponded to a score above the population 20th percentile for boys and 30th percentile for girls, compared to the mean scores for the "at risk group" which reflected a score above the population 45th percentile for boys, and above the 60th percentile for girls. Thus, for girls at least, the levels of hyperactivity in the "at risk" group were above the levels expected of over half of the population. The pattern was even more striking with regard to parent-rated hyperactivity, in which the mean score in the "low risk" group was indicative of a score above the population 30th percentile for boys and 50th percentile for girls, whereas in the "at risk" group mean hyperactivity levels were above the population 55th percentile for boys and 75th percentile for girls. Here, both boys and girls in the "at risk" group were more hyperactive than over half of the population, with girls' hyperactivity levels higher than three-quarters of the population.

Both measures of hyperactivity continued to distinguish the groups even after controlling for the effects of non-verbal and verbal ability, indicating that poorer cognitive functioning in the "at risk" group relative to the "low risk" group was not responsible for their higher levels of parent and teacher-rated hyperactivity. Experimenter-rated hyperactivity was also significantly elevated in the "at risk" group compared to the "low risk" group, although the magnitude of the difference was weaker (effect size 0.39) and did not remain significant after controlling for non-verbal and verbal ability. Thus, poorer cognitive ability of the "at risk" group may have accounted for much of the differences in levels of hyperactivity observed by the experimenter during the testing session. However, the fact that the results for two of the three raters provided consistent and robust support for the hypothesis suggests that overall the "at risk" group were more hyperactive than the "low risk" group.

Symptoms of hyperactivity alongside conduct problems have been demonstrated to constitute a poorer prognosis in terms of long-term outcome than symptoms of either disorder alone (Moffitt, 1990; Babinski et al, 1999). The present findings suggest that such a profile is identifiable as early as age 3, suggesting the potential for persistent problems in the future for this group of "at risk" children. The fact that deficits in IC were not evident amongst this group perhaps speaks against theories which have suggested that the "conduct problems + hyperactivity" behavioural profile constitutes a qualitatively distinct group with neuropsychological impairments such as IC (Lynam, 1996). It is tenable however, as discussed in relation to the association between IC and conduct problems, that the cognitive deficits of this group are merely expressed in a different way at this young age.

The findings cannot attest to the notion that hyperactivity precedes and predicts conduct problems (Patterson et al, 2000) or that conduct problems are a complication of hyperactivity (Taylor et al, 1996), since the two symptom profiles are already evident at a young age. The results do suggest, however, that if conduct problems do result from early hyperactivity that this process occurs very early in life and that a long and established period of hyperactivity is not a necessary precursor of conduct problems, at least not those evident at age 3.

In sum, as early as age 3 there are a number of indicators for poor outcome in children presenting with early risk for conduct problems. In fact the prognosis for these "at risk" children does not look promising given the impairments already evident across other areas of functioning which have been associated with persistent and severe antisocial behaviour in older children and adults. Not only do they present with early risk for conduct problems, in itself an indicator for later antisocial behaviour

(Moffitt, 1993), but they are also already functioning at a level below their peers with regard to verbal ability, social skills and hyperactivity.

2.4.3 Risk factor profiles of children with pervasive versus situational risk for conduct problems

The prospects for children with early conduct problems look bleak given the associated impairments across other areas of functioning. However, we might expect to see even greater impairment in functioning in children with pervasive conduct problems, as rated by both parents and teachers across the contexts of home and nursery. Loeber (1990) asserted that behaviour problems that occur across settings predict a greater likelihood of persistence and severity over time than those which occur in only one context. It was of interest in this chapter to determine the risk factors associated with pervasive conduct problems at age 3, and the extent to which they might be predictive of poorer outcome in follow-up assessments. Essentially, the aim was to determine whether children with pervasive conduct problems could be distinguished from children with situational conduct problems on other areas of functioning as early as age 3. This was a particularly ambitious aim, given that all children in the "at risk" group have already been demonstrated to be significantly impaired on a number of areas of functioning. In order for the pervasive group to demonstrate significantly poorer functioning than the rest of the already "at risk" group, they would need to show considerable impairments on the risk factor measures.

Results indicated that across the range of risk factors included in the analyses, children with pervasive conduct problems scored poorly compared with children with situational conduct problems. With regard to non-verbal IQ, differences between the groups were not significant, yet the groups did differ significantly on verbal ability, with a moderate effect size of 0.71. Children with situational conduct problems presented with a mean score for verbal ability within the population average range (88.23), whilst children with pervasive conduct problems had a mean score of almost a standard deviation below the situational group, bordering on learning disability level (75.50). When shared variance with non-verbal IQ was taken into account in the analyses, differences still approached significance and showed a non-significant trend towards lower verbal ability in the pervasive conduct group relative to the situational conduct group. Results suggested however that higher levels of hyperactivity in the pervasive group might have accounted for this difference, since the group differences with regard to verbal ability no longer reached statistical significance when controlling for concurrent ratings of hyperactivity.

No differences emerged between the two groups with regard to theory of mind and inhibitory control competencies, indicating that at this age and with the measures used in the current study, there was no evidence that superior mentalising ability was evident in the situational conduct group which could account for the situation-specific nature of their conduct problems or indicate potential protective factors against continued problems relative to the pervasive conduct group.

Both parent and teacher-rated social skills were poorer in the pervasive conduct group than in the situational conduct group. This finding was particularly striking with regard to teacher-rated social skills (with a large effect size 1.11), of which the mean score was well within the normal range for the situational conduct group (90.33), whilst the mean score for the pervasive group was over a standard deviation below, again bordering on a level of functioning associated with learning disability (72.56). This difference remained significant even when controlling for non-verbal and verbal ability, but not when controlling for hyperactivity. Parent-rated social skills followed a similar pattern although the group differences fell just short of statistical significance (moderate effect size of 0.62). Again, differences remained when covarying for intellectual ability, but fell well below significance when controlling for hyperactivity. Thus, the pervasive group were functioning particularly poorly with regard to social skills, and whilst this was not due to poorer cognitive ability, it may have been due to the higher levels of hyperactivity in the pervasive group.

Finally, both parent and teacher ratings of hyperactivity were significantly higher for the pervasive group than the situational group. The effect size of 1.07 with regard to teacher-rated hyperactivity reflected the most marked difference, whilst a moderate effect size of 0.62 differentiated the groups with regard to parent-rated hyperactivity. The higher levels of hyperactivity in the pervasive group according to parents were nevertheless no longer significant after controlling for verbal and non-verbal ability. However, with regard to teacher-rated hyperactivity the significant differences remained despite controlling for these aspects of cognition. The difference in hyperactivity levels between the two groups, according to teachers, was so marked that even though the mean score for the situational group was already reflective of a score above the population 40^{th} percentile for boys and 64^{th} percentile for girls, an even higher mean score of 6.25 represented the pervasive group, corresponding to levels of hyperactivity above the population 73rd percentile for boys and 90th percentile for girls.

In sum, across the range of risk factors, but significantly with regard to the risk factors which were found to be important in differentiating the "at risk" from the "low risk" group, children with pervasive conduct problems presented with an even poorer profile and prognosis for outcome. Their presentation carries a high risk for continued problems at follow-up and potentially later in development. They are only 3 years old and only just entering the social world of the nursery environment. Yet already they are presenting with conduct problems above the 90th percentile for normative development both at home and at school. In addition they are functioning at a significantly poorer level than their peers across a range of areas of functioning: they have poor verbal ability, poor social skills and elevated levels of hyperactivity, relative to children with conduct problems present in only one context. These impairments in functioning are extreme: they are bordering on learning disability level with regard to verbal ability and teacher-rated social skills, and their hyperactivity levels are higher than 75% of the population of boys, and 90% of the population of girls. Thus, to an even greater degree than for the "at risk" group in general, this pervasive sub-group are at especially heightened risk for later problems and already present with significant cause for concern across a pervasive set of risk factors.

2.4.4 Proportion of boys and girls in "at risk" group

No significant differences were found between the proportion of boys and girls identified "at risk" for conduct problems. In fact, there was a trend towards a greater proportion of girls than boys in the "at risk" group. These results are consistent with a number of previous studies with regard to levels of conduct problems in pre-school children (Keenan & Shaw, 1994; Rose, Rose & Feldman, 1989; Richman et al, 1982). Richman et al's (1982) Waltham Forest Study for example, reported that whilst boys displayed higher levels of bladder and bowel control problems than girls at age 3, and higher (though not dramatically so) levels of over-activity and restlessness, there were no significant gender differences in the extent to which children were rated as difficult to control or prone to temper tantrums.

The results are in direct contrast to established findings regarding older children, whereby from as early as age 4 (Offord et al, 1987; Moffitt et al, 2001) boys are reported to display a higher prevalence of conduct problems. In fact, across all ages in the Dunedin Multidisciplinary Study (starting from age 5), boys displayed significantly higher levels of antisocial behaviour, regardless of the definition or measures used, ranging from self-report or caregiver report questionnaires establishing a dimensional metric of antisocial behaviour, through to clinical diagnoses and criminal convictions (Moffitt et al, 2001). The fact that similar levels of boys and girls in this 3-year-old sample were found to present with early risk for conduct problems is interesting for a number of reasons. Firstly, hypotheses asserting a genetic explanation for the higher prevalence of conduct problems in boys beyond the pre-school years might have difficulty explaining why such a genetic predisposition does not manifest itself until later in development. The fact that the period of time corresponding to school entry appears to mark the developmental transition in girls towards a cessation of conduct problems appears more consistent with a socialisation account of the differences. Possibly conduct problems are not as socially acceptable in girls and they are socialised to express conflict in different ways.

Of course, it could be argued that the genetic propensity in boys to develop and maintain conduct problems is triggered by environmental stressors such as entering school, which they may not be so well equipped to cope with as girls. In either case, even if the onset of conduct problems in boys and girls have different underlying causes, it is interesting to note that prior to immersion in the social and academic world of school, boys and girls are equally likely to display conduct problems. However, it should be noted that the findings in this sample of children could be specific to the high risk population from which the sample was drawn and hence not replicable in other samples. Possibly something specific to the environment of these children fosters conduct problems in girls and raises them to higher levels than would be expected in other samples. Whilst this possibility should not be overlooked, it is still striking that even if this sample represents children with atypically high levels of environmental risk, the impact on girls' behaviour at least at this early age is equal to if not more pronounced than boys. It will be interesting to note whether investigation of the sample at one-year follow-up will produce comparable results to other studies, with fewer girls than boys having conduct problems, or whether girls in the present sample will be more likely to continue to display conduct problems than has been the case in previous studies of girls.

Another explanation for the similar level of pathology in boys and girls with regard to conduct problems at this early age is the possibility that boys and girls fell above the cut-off on different items. That is to say, might different aspects of conduct problems characterise boys and girls?

Previous researchers, for example, have suggested that girls may present with a different profile of antisocial behaviour, namely "social aggression" which involves more subtle antisocial behaviours such as spreading rumours or talking behind someone's back (Bjorkqvist et al, 1992; Crick & Grotpeter, 1995). Thus, in accordance with this theory, girls might be expected to score more highly on the social items of the "conduct problems" sub-scales than those concerned with physical aggression. The items relating to conduct problems on the SDQ are the same for parent and teacher versions, and consist of the following: "Often has temper tantrums or hot tempers", "Generally obedient, usually does what adults request", "Often fights with other children or bullies them", "Often argumentative with adults" and "Can be spiteful to others".

The only sub-scale for which a gender difference was found was with regard to the parent SDQ item: "Often fights with other children or bullies them" (see appendix G). Girls were more likely than boys to receive a rating of "not true" on this item. This is only partially consistent with the "social aggression" hypothesis, since girls are only considered less physically aggressive according to parent reports, not teacher reports, and the theory might also predict that girls should receive higher scores than boys on the "Can be spiteful to others" item, yet this was not the case. Of course, if girls are indeed as subtle about their forms of antisocial behaviour as the theory describes, then it is possible that parents and teachers might be unaware of any such behaviour and therefore unable to rate it. In general however, teachers rated boys and girls on similar items, and aside from elevated physical aggression in parental reports, so did parents.

2.4.5 Risk factor profiles of boys versus girls within the "at risk" group

- **Non-verbal IQ and verbal ability**

No significant differences emerged between "at risk" boys and girls with regard to verbal ability. As was the case for the "at risk" group overall, impairments in verbal ability were characteristic of both "at risk" boys and girls, each presenting with mean scores around or just below the lower end of the average range. However, there was a non-significant trend towards higher non-verbal IQ scores in "at risk" girls compared with "at risk" boys, with a weak effect size of 0.46. Mean non-verbal IQ for "at risk" girls was within the population average range (92.95), whilst boys' mean score was half a standard deviation below, and below the population average range of functioning (84.89). This finding is consistent with Richman et al's (1982) results from the Waltham Forest Study, in which boys with behaviour problems showed impairments in intellectual functioning whilst girls did not. However, in the present study this finding only relates to non-verbal cognitive ability. There was, however, no evidence that Sonuga-Barke et al's (1994) findings were replicated with regard to the cognitive developmental advantage of girls in the "at risk" group. Whilst "at risk" girls showed a tendency towards higher non-verbal IQ than "at risk" boys, they were not functioning at a higher level than children in the "low risk" group. Thus, it seems more appropriate to consider the relative lack of impairment as a protective factor for future functioning in girls rather than a causal factor in the conduct problems themselves.

Indeed, if cognitive impairment is seen as causative in its relationship with conduct problems as suggested by Goodman et al's (1995) investigation of the most plausible accounts, then possibly a different route to conduct problems in girls is implicated. Nevertheless, the gender differences did not quite reach statistical significance, and with such a shortage of research teasing apart verbal and non-verbal cognitive ability, it could be the case that in fact it is deficits in verbal ability which are important for the development of conduct problems, and these were equally prevalent across gender. It remains to be seen whether girls' average-range non-verbal IQ might act as a protective factor against continued conduct problems in spite of the fact that they do show impairments in verbal ability. One might argue that opportunities to respond to intervention would be more likely in a group with average-level cognitive functioning than a group functioning below the population average level, due to heightened awareness of the consequences of their actions or greater capacity to carry out cognitive and behavioural strategies aimed at decreasing antisocial behaviour. Furthermore, negative effects associated with poor school attainment (Finn, 1989; Turner, Husman & Schallert, 2002) would be less likely to occur and exacerbate conduct problems in the absence of non-verbal cognitive impairments.

- **Theory of mind**

A non-significant trend was evident in the direction of poorer theory of mind understanding in "at risk" boys relative to "at risk" girls, although this effect seemed to be predominantly carried by poorer cognitive functioning in the boys, and higher levels of hyperactivity. Nevertheless, when the theory of mind tasks were separated into the composites for tasks measuring earlier-emerging theory of mind understanding and later-emerging skills, a significant difference was found. "At risk" girls were significantly better at passing tasks tapping earlier-emerging theory of mind competencies than "at risk" boys. This difference still approached significance even when covarying for the variance explained by non-verbal and verbal cognitive ability, although was no longer significant after co-varying for hyperactivity. Thus, higher levels of hyperactivity in "at risk" boys relative to "at risk" girls might have accounted for a large proportion of the gender difference in theory of mind competency.

The above findings have numerous implications for understanding pathways to and from early conduct problems for boys and girls, as well as understanding the developmental associations between theory of mind and other cognitive and neuropsychological functions such as verbal ability.

The capacity to understand false beliefs and their impact on a person's thoughts, feelings and behaviour is undergoing a significant developmental transition between the ages of 3 and 4 years old (Astington et al, 1988). It may be too early at age 3 therefore to analyse differences in an aspect of mentalising which has not yet fully developed for a large number of children. The fact that a difference is notable with regard to understanding that other people can hold beliefs and desires which differ from their own and which will guide a person's actions, suggests that a developmental discrepancy is emerging in mentalising development between girls and boys "at risk" for conduct problems as early as age 3. This finding is consistent with findings regarding pre-school boys and girls without conduct problems (Charman et al, 2002), in that girls were shown to be slightly advanced in terms of theory of mind development.

Assuming that the above developmental account is correct and that girls' capacity to understand the minds of others is not impaired in the presence of risk for early conduct problems whilst it is for boys, what might this mean for our understanding of gender differences in the emergence and continuity of conduct problems? Firstly, if one adheres to the notion that associations found between conduct problems and a delay or deviance in theory of mind understanding (e.g. Hughes et al, 1998) reflects a causal role of deficits in mentalising in the onset of conduct problems, then one can only assume that this pathway to conduct problems is not applicable to girls. It is possible to speculate that impairments to the frontal lobe region of the brain responsible for the development of theory of mind are present in boys and that the consequent inability to appreciate the thoughts, feelings and perceptions of others makes conduct problems more likely. However, further evidence for a relative impairment in boys versus girls to other areas of functioning implicated in the same region of the brain would be necessary to confirm this hypothesis, and as the following section will reveal, no such evidence can be presented in the present findings. It would also be necessary following this account, to provide a hypothesis explaining possible alternative routes to conduct problems for girls which do not involve cognitive or neuropsychological impairments. As yet, no such alternative route is suggested, and in fact much of the evidence to date suggests that similar factors are likely to lead to conduct problems for boys and girls (Moffitt et al, 2001).

Perhaps a more useful interpretation of the results therefore might be to predict the possible future implications for boys and girls with early risk for conduct problems, given the developmental advantage in the mentalising capacity of girls. Much evidence in the literature points towards positive associations of theory of mind competency with other areas of adjustment such as active engagement in pretend play (Taylor & Carlson, 1997), school adjustment (Dunn, 1995), positive mother-child interaction (Ruffman et al, 1999) and peer acceptance (Slaughter et al, 2002). By having the capacity to understand others' minds, girls with conduct problems may be more likely to benefit from the positive effects of other aspects of social adjustment such as peer group acceptance and positive parental relationships. Since impairments in many of these areas of social functioning are associated with persistent and severe conduct problems (e.g. Patterson, 1982; Dodge, 1980), and boys may be at greater risk for social maladjustment due to delayed theory of mind development, it follows that the discrepancy in mentalising capacity between the genders could act as a significant protective factor for girls against many of the mediating effects of social maladjustment.

It is well established in the literature that a strong positive association exists between theory of mind and verbal ability (DeVilliers, 1999; Ruffman, Slade, Rowlandson, Rumsey & Garnham, 2003; Watson, Painter & Bornstein, 2001;), and this has fuelled much speculation within the age-old debate around whether language is necessary for thought and thus higher-order thought processes such as theory of mind (De Villiers, 1999). Some theorists have argued that competency in verbal cognitive functioning is necessary for the development of theory of mind (Dunn et al, 1991), whilst others have proposed that a child must first grasp concepts of mental states before they can learn to talk about them (Fodor, 1992). Yet others have proposed that a synthesis of the two theories is more accurate (Karmiloff-Smith, 1992). Thus, although studies of deaf children's delayed theory of mind acquisition (e.g. De Villiers & De Villiers, 1999) offer support to the theory that competency in language aids theory of mind development, one can on the other hand appreciate how conversational skills require a complex understanding and monitoring of the listener afforded by theory of mind competency (De Villiers, 1999).

Findings relating to girls with early risk for conduct problems in the present study are inconsistent with the notion that language competency is necessary for theory of mind development. They have impairments in verbal cognitive functioning relative to children without risk for conduct problems, yet at this stage in development at least, their theory of mind development is not impaired or delayed. Further, theory of mind competency (with regard to the earlier-emerging mentalising skills) distinguishes between boys and girls "at risk" for conduct problems to a level approaching significance even when the influence of verbal ability is controlled for. The possibility that the verbal impairments of the girls will impact upon their theory of mind development at a later stage cannot be overlooked, but it is interesting to note that in its early stages of development, theory of mind does not necessarily depend upon age-appropriate verbal functioning. The conjecture that a bi-directional causal relationship exists between mentalising ability and language (Karmilloff-Smith, 1992; De Villiers, 1999) is therefore supported by the present findings.

- **Inhibitory control**

No significant differences emerged between "at risk" boys and girls in their performance on tasks measuring inhibitory control. This is in addition to the previously reported finding that inhibitory control also did not differentiate between children with and without risk for early conduct problems. As argued in response to the latter finding, it is possible that the developmental stage of the children with regard to the developing capacity to inhibit pre-potent or dominant responses, was too early for any emerging differences to be demonstrated using the tasks in this study. No evidence to support or refute the theory of different causal routes to early conduct problems for boys and girls, involving frontal lobe functioning, could be provided by this finding.

Interestingly, the finding also offers some insight into the association between theory of mind and inhibitory control and executive functioning in general. The interdependence of the two functions are a topic of great debate in the literature, with one side arguing for the emergence of theory of mind as dependent upon executive abilities such as inhibitory control (Carlson & Moses, 2001; Carlson, Moses & Breton, 2002; Carlson, Moses & Hix, 1998; Hughes, 1998; Russell, Jarrold & Potel, 1994; Russell, Mauthner, Sharpe & Tidswell, 1991) and the other side arguing the opposite (Frith, 1992;

Perner, 1998). In the present study, "at risk" girls showed superior performance on some theory of mind tasks to "at risk" boys, whilst inhibitory control competency was at a low level for both "at risk" girls and boys. The capacity for theory of mind competency to manifest itself in the absence of inhibitory control competency suggests that theory of mind development is not dependent upon the prior emergence of inhibitory control. Of course, the specific tasks used may have influenced this result. The Wellman tasks tapping "not own belief" and "not own desire" understanding could be argued to place less demand upon inhibitory processes, since with regard to the not own belief task at least, the object of interest (the puppy) is not physically present to distract the child from the correct response. However, it might also be argued that the lack of demand placed on inhibitory control in this task makes it a "purer" measure of theory of mind, and that the fact that it can be passed even if inhibitory control tasks are not passed offers even greater support for the independence of theory of mind from inhibitory control. One should bear in mind that the tasks used to tap inhibitory control could be more advanced than the corresponding theory of mind tasks, and the developmental associations between the two functions might therefore be more closely related than is suggested by the tasks used in this study.

- **Social skills**

No significant differences in the parent or teacher-rated social skills of "at risk" boys compared with "at risk" girls were revealed. This was in contrast to our hypothesis that, based on previous findings attesting to slightly elevated social skills in girls in the general population (Bosacki & Astington, 1999; Matthews & Keating, 1995), that better social skills in "at risk" girls might help explain the fact that girls are less likely to persist in early-onset conduct problems (Silverthorn & Frick, 1999). The present findings are not consistent with the notion that superior social skills act as a protective factor for girls against the negative impact of early-onset risk for conduct problems. If such a protective factor does exist, either it is something other than social skills, or our measure of social skills is not sensitive to the particular aspects of social competency that these "at risk" girls possess.

- **Hyperactivity**

Consistent with our hypotheses, hyperactivity levels were found to differentiate "at risk" boys and girls, with boys displaying significantly elevated levels of hyperactivity. However, this was only with regard to experimenter-rated hyperactivity, with a moderate effect size of 0.67. Parent and teacher-rated hyperactivity were at comparable levels for "at risk" boys and girls. The gender difference with regard to experimenter-rated hyperactivity was fairly robust, and continued to approach significance even after controlling for non-verbal and verbal ability. This indicates that the elevated hyperactivity in boys relative to girls was not due to poorer cognitive ability in boys.

Moffitt et al (2001) reported that hyperactivity was the most important risk factor for conduct problems according to results drawn from the Dunedin Longitudinal Study, and that differences in hyperactivity between boys and girls accounted for a significant proportion of the gender differences in the prevalence of conduct problems. Considering that the co-morbid profile of hyperactivity symptoms and conduct problems is predictive of poorer outcome than either symptom pattern alone (e.g. Moffit, 1990; Babinski et al, 1999), boys would be expected to be more likely to persist in their antisocial behaviour than girls. If we also adhere to the notion that the "hyperactivity + conduct problems" profile could reflect a stronger underlying genetic or biological component (Lynam, 1996), then this could also potentially implicate a stronger inherited or biologically-driven mechanism behind early emerging conduct problems in boys than in girls, which might also predict greater stability in boys of early identified risk for conduct problems.

Hinshaw (1992) discussed the possibility that the association between cognitive ability and conduct problems was in fact limited to hyperactivity, and that any observed association between cognitive ability and conduct problems would be due to the overlap between conduct problems and hyperactivity. The present findings offer partial and tentative support for this notion. "At risk" girls presented with a trend towards a less impaired cognitive profile than boys, but only with regard to theory of mind and non-verbal ability. Concurrently, "at risk" boys were more likely to be hyperactive, though only according to experimenters, and controlling for hyperactivity resulted in the gender differences for theory of mind and non-verbal ability to fall well below significance. Thus, perhaps the impairment in non-verbal ability and theory of mind in "at risk" boys is caused by the co-morbid symptoms of hyperactivity. The hyperactive aspect of the boys' behavioural profile could therefore provide a key to many of the differences emerging between boys and girls with early risk for conduct problems. If hyperactivity is a marker for cognitive impairments associated with poor outcome for conduct disorder, and conduct problems are present alongside it, the opportunities for negative outcome will be multiplied for boys.

2.5 Chapter summary

- Overall, a particularly high level of pathology with regard to levels of conduct problems was identified, with 33% of children falling above the population 90th percentile cut-off point and deemed "at risk".
- "At risk" children were functioning at a significantly poorer level than their "low risk" peers. Specifically they were impaired on measures of verbal ability and social skills, and presented with elevated levels of hyperactivity.
- A "pervasive" risk group, rated by both parent and teachers as having early conduct problems, showed an even more worrying risk factor profile. These children were functioning at borderline learning disability level with regard to verbal ability and social skills, and above 90% of the population with regard to levels of hyperactivity.
- A similar proportion of boys and girls fell into the "at risk" group.
- "At risk" girls performed mildly better on tasks measuring early emerging mentalising skills than "at risk" boys, and showed a non-significant trend towards higher non-verbal IQs.
- "At risk" boys presented with significantly higher levels of experimenter-rated hyperactivity than "at risk" girls. Moreover, boys' higher levels of hyperactivity appeared to account for their relative deficit in non-verbal IQ and theory of mind competency compared with "at risk" girls. Might hyperactivity therefore hold the key to understanding gender differences in the continuity of early identified risk for conduct problems?

3

Associations between behaviour and cognition at age 3: Cross-sectional dimensional analyses

3.1 Overview of the literature and chapter aims and hypotheses

A clear distinction is often made between different disciplines such as psychiatry and psychology with regard to whether psychopathology should be considered in a categorical or dimensional way (Pickles & Angold, 2003). Some researchers have posited that the former view fits better with a predominantly "within individual" account of the aetiology of psychopathology such as biological or genetic accounts, whilst the latter is better suited to environmental accounts such as psychosocial theories (e.g. Sonuga-Barke, 1998) and that one view should be adopted over and above the other depending on the particular account favoured. However, recently attempts have been made to consider the two concepts concurrently (e.g. Goodman et al, 1995; Plomin et al, 2002) with the view that both ways of conceptualising psychopathology can be useful and that often the two seemingly disparate schools of thought do in fact overlap. Checklists such as the Child Behaviour Checklist (CBCL, Achenbach, 1991), for example, require the informant to switch between categorical and dimensional conceptions interchangeably in order to rate the child's behaviour (Pickles & Angold, 2003).

As well as a potential overlap between the categorical and dimensional conceptions of psychopathology in every day assessment tools, there are important intervention implications for choosing one view over another, and as such both categorical and dimensional theories should be considered useful ways of conceptualising psychopathology. Pharmacological treatment of ADHD for example might require a categorical distinction between a "case" and a "non-case" given that low levels of hyperactivity will not benefit from low levels of drug administration and could potentially be harmful. Community health initiatives however might be more inclined towards a dimensional view, given that reducing symptoms will be a health benefit to the individual wherever they fall on the continuum (Pickles & Angold, 2003).

There are a number of other good reasons for analysing the data in a dimensional way in addition to the categorical method used in the previous chapter. Increased power to detect associations is afforded by the larger data set available in the whole group analyses. Moreover, large community samples can help address the issue of whether associations for extreme selected groups are greater than would be expected of the associations for the distribution as a whole (Plomin et al, 2002). Thus, it could be possible to establish whether disorders are simply quantitative extremes of the same processes underlying broader variation in the whole distribution, or whether they represent qualitatively different processes specific to the extreme end of the distribution.

Furthermore, analysing the current data set in a dimensional way will enable a wider spectrum of behaviours to be examined in addition to conduct problems. Other aspects of behaviour could not be considered as outcome measures of behaviour in the categorical chapter since the groups were selected on the basis of extreme scores on the conduct problems sub-scale only, this being the behaviour of specific interest. In this chapter it is possible to explore the nature of normative variations in levels of conduct problems and their associations with other areas of functioning, as well as their place alongside normative variations in the symptom levels of hyperactivity. Are the associated deficits in other areas of functioning seen in children with extreme levels of conduct problems also present across the whole distribution of scores on the conduct problems scale, and are these specific to conduct problems or also applicable to hyperactivity? In addition, whilst the "at risk" and "low risk" groups in chapter 2 were made up of a combination of children rated by parents, teachers or both parents and teachers as having particularly high or low levels of conduct problems, in the present chapter it is possible to consider parent and teacher ratings of behaviour separately.

The present chapter will investigate associations between children's verbal ability (BPVS) and non-verbal IQ (BAS) and behavioural adjustment in terms of conduct problems (SDQ: parent and teacher ratings) and hyperactivity (SDQ: parent and teacher ratings; HBRS: experimenter rating).

Associations between these behavioural measures and theory of mind (Sally-Anne, Smarties, Not own belief, Not own desire) and inhibitory control (Luria's handgame, Day/Night) will also be investigated. All of the analyses will be looked at across the sample as a whole. With regard to conduct problems which have been examined categorically, the extent to which the results pertaining to cognitive and neuropsychological functioning at extreme ends of the distribution can be applied to a wider range of variations in conduct problems across the whole sample will be considered. The validity of investigating this question statistically is constrained by the fact that the categorical analyses were concerned with ANOVAs comparing mean scores between the different "risk" groups on the cognitive measures (IC, ToM, verbal ability and non-verbal IQ) as outcome or dependent variables, whereas the present chapter will employ correlational analyses and regression equations to examine associations between behavioural and cognitive measures as dimensional and continuous variables. However, it is still possible to note whether significant effects were found between two measures in the categorical versus dimensional analyses.

One further difference between the categorical and dimensional chapters is that parent, teacher and experimenter-rated hyperactivity were analysed as dependent variables or "risk factors" in the categorical analyses, in terms of their association with extreme levels of conduct problems, whereas in the present chapter hyperactivity shall be considered as an independent outcome measure of behaviour, alongside conduct problems, to determine whether the two aspects of behaviour are differentially associated with cognition. In order to more carefully control for the comorbidity between hyperactivity and conduct problems, analyses concerned with associations between hyperactivity and cognition will control for the presence of conduct problems, and analyses concerned with associations between conduct problems and cognition will control for the presence of hyperactivity. In this way, the independent associations with aspects of cognition for each measure of behaviour can be more reliably determined.

The present chapter therefore has a number of novel elements which can make a unique and informative contribution to the field. Firstly, an attempt is made to separate constructs of conduct problems and hyperactivity and control for the shared variance between these co-morbid behaviours, rather than considering "externalising behaviour", which combines both constructs, as the behavioural outcome of interest. In so doing we can contribute to the literature by attempting to disentangle the cognitive correlates which may be specific to one or other of these behavioural profiles. Secondly, cognitive functioning is split into non-verbal IQ and verbal ability instead of focusing on an overall full-scale IQ score, which will enable the independent associations of verbal versus non-verbal ability with behaviour to be analysed. In addition some more experimental measures of cognitive functioning are also measured, which have been demonstrated to be associated with autism (ToM) or clinically diagnosed AD/HD (IC), but are applied here to associations with variations across the whole sample in levels of conduct problems and hyperactivity. Determining more specifically the associations between cognition and behaviour is important for gaining a better understanding of the nature of hyperactivity and conduct problems, and therefore enabling remedial programmes to be tailored to the particular behaviour of concern, targeting more precisely the deficits associated with a given behavioural profile.

Thirdly, we will be able to contrast findings related to cognitive functioning in children with extreme levels of conduct problems (reported in chapter 2) with associations found across the range of variation in conduct problems in the sample as a whole. This could have important implications for intervention initiatives, which may be able to apply similar remedial strategies to improving the behaviour of children with low-level behaviour problems as are used for extreme or clinically significant behaviour problems. Thus, preventative measures could be implemented in the form of universal programmes targeting all levels of behaviour, regardless of the extent of the problems. On the other hand, if associations are specific to the extreme end of the behavioural continuum then intervention strategies would be best implemented in clinical settings, and any attempt to apply them as preventative measures in non-clinical populations could potentially be a waste of resources. Finally, the children in the present study are younger than in the majority of previously reported studies, particularly those pertaining to associations between IC and ToM and behaviour (e.g. Nigg et al, 1999's study of 6 to 8-year-olds, Buitelaar et al's (1999) sample of 8 – 18 year olds). Therefore we can begin to examine how early in development some of these associations may be observable. This could help determine the optimal timing of any appropriate intervention initiatives.

3.1.1 Associations between conduct problems, hyperactivity and (verbal and non-verbal) IQ

A small number of community studies have looked at associations between cognitive functioning and behaviour across the whole sample, in order to determine whether variations in IQ across the whole sample might relate to variations in levels of externalising behaviour problems. The studies have been discussed in the previous chapter in relation to the extremes analyses, but a further description with particular reference to their findings relating to whole sample analyses is warranted here. Studies in the field taking a dimensional approach to the association between cognitive ability and behaviour problems are sparse, and hence the dimensional analyses in the present study will help add to the literature in this area.

In their epidemiological sample of 13-year-old twins, Goodman, Simonoff and Stevenson (1995) reported that child IQ, as measured by the WISC-R (Weschler, 1974) Full-scale IQ, was significantly negatively correlated with levels of conduct problems, hyperactivity and total problem scores according to both parents and teachers, as rated by the Rutter questionnaires (Rutter, Tizard & Whitmore, 1970; Rutter, 1967). Thus, in the population as a whole, according to this study, impairments in cognitive functioning are associated with behavioural maladjustment across a range of behaviour problems. This pattern of association is therefore not limited to extreme ends of the distribution, indicating that children with clinical levels of behaviour problems might differ only quantitatively in the *extent* of impairment from children at lower ends of the distribution, on the *same* cognitive processes, rather than qualitatively impaired on *different* areas of functioning to those associated with behavioural variation in the normal range.

Indeed, Plomin et al (2002) confirmed this in their community study of 4,000 pairs of twins. The twins were assessed at 2, 3 and 4 years of age on parent-report and parent-administered measures of their children's verbal and non-verbal cognitive ability (MCDI, Dale et al, 1998; PARCA, Saudino et al, 1998), as well as parent-rated problem behaviour using the Revised Rutter Parent Scale for Pre-school Children (RRPSPC; Hogg, Rutter & Richman, 1997). The RRSPC yielded sub-scales relating to anxiety, conduct problems and hyperactivity, but since results were comparable for all scales, the total problems score was used as the behavioural measure in the analyses. Similar results were reported for children scoring at extreme ends of the distribution with regard to verbal and non-verbal cognitive ability and for the sample as a whole. Although relating to extreme levels of cognitive impairment as opposed to extreme levels of behaviour problems, the study suggests that a similar pattern of association is evident at extreme ends of the distribution and across the whole sample. The study found modest negative associations between verbal and non-verbal cognitive ability and behaviour problems at ages 2, 3 and 4, and this pattern was stronger for boys than for girls. The strengths of associations increased incrementally with age and were greater for non-verbal than verbal cognitive ability.

In terms of the non-verbal/verbal distinction with regard to cognition, the consensus from studies which have attempted to look at specific associations between behaviour and cognition has been that the predominant cognitive impairment associated with conduct problems (albeit conduct problems of a clinical/extreme level) is verbal ability (Elkins et al, 1997; Moffitt, 1990). Nevertheless, many researchers have suggested that any association between cognitive impairments (be they verbal or non-verbal) and conduct problems only exist by virtue of associated hyperactivity (e.g. Hinshaw, 1992). Thus, it is hypothesised that it is the hyperactivity, rather than the conduct problems, that is associated with the cognitive deficit. On a related vein, others have argued that whilst a genetic vulnerability underlies hyperactivity, also predisposing children to various cognitive deficits, conduct problems are primarily a result of environmental influences (Rutter et al, 1999). Studies attempting to tease apart the behavioural symptoms of conduct problems and hyperactivity to address this issue, have reported inconsistent findings. Goodman et al (1995), for example, in their study of 13-year-old children, found a stronger association between low IQ and conduct problems than between low IQ and hyperactivity. Sonuga-Barke et al (1994) on the other hand, found that amongst preschoolers selected for the presence of hyperactivity or conduct problems, hyperactivity but not conduct problems predicted low general intelligence.

One further complication in this debate is the finding that children with symptoms of both hyperactivity and conduct problems have been shown to demonstrate significantly more severe cognitive deficits than those with either symptom profile alone (Moffitt & Henry, 1989). This could be because both behavioural profiles are associated with cognitive deficits and thus they combine in an additive way to produce stronger impairments, suggesting that conduct problems are in fact associated with cognitive impairments. However, an alternative view is that the "conduct problems + hyperactivity" profile is a qualitatively distinct disorder (Lynam, 1996), and by this account we could not deduce anything about either conduct problems or hyperactivity from findings relating to this symptom profile.

Very few studies to date have combined the following elements to address this array of inconsistent findings: non-verbal versus verbal ability, conduct problems versus hyperactivity, and categorical or extreme levels of behaviour versus dimensional or continuous measures of behaviour. The present study shall be one of the first attempts to address some of these areas of contention in the literature and to unravel the complex inter-associations between specific areas of behaviour and cognitive ability across whole-sample variations in levels of these behaviours.

3.1.2 Associations between conduct problems, hyperactivity, ToM and IC

More recently, studies have begun to consider the role of neuropsychological processes in the cognitive profile of behaviour problems. Impairments in inhibitory control have been consistently found in children with ADHD (Nigg, 1999, 2001; Perner, Kain & Barchfield, 2002), and have even been implicated in causal theories (Barkley, 1997) suggesting that the inability to inhibit pre-potent responses, possibly stemming from impairments in frontal regions of the brain, are responsible at least in part for the behaviour problems characteristic of ADHD.

This has led to a surge of interest in executive abilities in children with conduct problems, from which many studies have shown that deficits in inhibitory control are evident in this population (Raine, 2002), independently of co-morbid ADHD (Giancola, Mezzich & Tarter, 1998; Seguin, Boulerice, Harden, Tremblay & Pihl, 1999). Thus, the inability to suppress behavioural responses could also underlie antisocial and disruptive behaviour, and may not be limited to hyperactive behaviour. Nevertheless, other researchers have found that IC impairments are specific to hyperactivity, and that when co-morbid hyperactivity is controlled for the negative association between IC and conduct problems disappears (Berlin & Bohlin, 2002).

The majority of studies, particularly those concerned with conduct problems, have focused on school-aged children, which have not therefore contributed to an understanding of how early the deficits might emerge, and the causal role they may play in the aetiology of the behaviour problems. Hughes, Dunn & White (1998) found impairments in inhibitory control in pre-school "hard-to-manage" children, yet these children were above a threshold on both hyperactivity and conduct problems, making it difficult to determine whether the results were reflective of the hyperactivity rather than the conduct problems.

Another neuropsychological process which has recently been studied in relation to behaviour problems is theory of mind, traditionally associated with autism (Baron-Cohen, 1995). Hughes et al (1998), in addition to impairments in IC, also found that her "hard to manage" pre-school children showed significant delay in theory of mind ability compared with controls. Again, it is unclear whether this finding relates more specifically to conduct problems or hyperactivity, or whether both behavioural profiles are associated with a theory of mind deficit. Buitelaar et al (1999) found that

ToM deficits characterised children with ADHD but not children with conduct problems, providing further support for the notion that cognitive impairments in conduct problems are merely a consequence of co-morbid hyperactivity. The findings from the above studies may suggest that a lack of understanding of the perspectives, thoughts and feelings of others renders children less likely to regulate their behaviour, or that engaging in antisocial or hyperactive behaviour impacts upon their social relationships with negative consequences for the emergence of competent social understanding. Clearly further studies are necessary to clarify both the specific behavioural profiles which are associated with such impairments, and the causal processes by which the association is formed.

To date, most studies of theory of mind and inhibitory control in relation to behaviour problems, as discussed above, have been concerned with categorical analyses of extreme ends of the behavioural distribution in order to ascertain their association with clinically significant behaviour problems (Hughes et al, 1998; Nigg, 1999, 2001; Moffitt & Henry, 1989). However, relatively little is known about how these neuropsychological processes are related to behaviour more generally in a non-clinical population. Understanding more about how individual differences in theory of mind and inhibitory control are related to a wider range of variations in behavioural adjustment might inform our understanding of their role in the aetiology and maintenance of symptoms such as conduct problems and hyperactivity.

3.1.3 Integrating the verbal/non-verbal and ToM and IC literatures

The common theme underlying all of the studies reviewed in sections 3.1.1 and 3.1.2 above is the contention surrounding the extent to which cognitive impairments in conduct problems are specific to conduct problems, shared with hyperactivity, or in fact relate only to hyperactivity. Nigg and Huang-Pollock (2003) proposed a hypothesis that may bridge the arguments put forward by proponents of the various different viewpoints. They argued that cognitive impairments underlie both conduct problems and hyperactivity. However, consistent with Rutter et al's (1999) view that environmental influences play an important role in the development and maintenance of conduct problems, they argued that the cognitive vulnerability manifests itself indirectly, via environmental risk, and only leads to conduct problems after a prolonged period of exposure to environmental risk. Hyperactivity, in contrast, was proposed to stem from a more direct cognitive vulnerability, which does not require environmental triggers.

Nevertheless, the theory does not account for instances in which controlling for hyperactivity removes the significant negative association between conduct problems and cognition (e.g. Berlin & Bohlin, 2002; Buitelaar et al, 1999). Presumably, according to the theory, if conduct problems are present then there should also be evidence of a cognitive deficit. It also does not specify how long the exposure to "environmental risk" would need to be before conduct problems manifested themselves. Thus, could this process occur before the pre-school years? If not, then the theory does not account for early-identified conduct problems in very young children.

Drawing on the general themes proposed by Nigg and Huang-Pollock (2003), as well as Rutter et al's (1999) contention that a stronger genetic component might underlie hyperactivity than conduct problems, we hypothesised that a more pervasive profile of cognitive impairment would be likely to be associated with hyperactivity than conduct problems. Indeed, a large number of studies have pointed towards stronger deficits across many areas of cognition in children with hyperactivity compared to children with conduct problems (e.g. Hinshaw, 1992; Sonuga-Barke et al, 1994; Berlin & Bohlin, 2002).

However, even if we adhere to the notion that conduct problems are less likely than hyperactivity to be directly caused by an underlying pervasive cognitive vulnerability, Nigg and Huang-Pollock (2003) did propose that a cognitive vulnerability could *indirectly* lead to conduct problems. Given the literature based on older children pertaining to the strong link between verbal ability and conduct problems (e.g. Moffitt, 1990; Elkins et al, 1997; Gilmour, Hill, Place & Skuse, 2004), despite the fact that many of these studies did not control for co-morbid hyperactivity, we hypothesised that perhaps a more specific cognitive impairment could underlie conduct problems. Having a specific verbal deficit could, in combination with an impoverished environment, lead to difficulty understanding and using language, and the resulting frustration might lead to aggressive or antisocial behaviour. From the opposite perspective, if we consider that "low cognitive ability is a consequence" of behavioural pathology rather than a cause (Goodman et al, 1995), conduct problems might be considered more likely to impact upon language and communication than intellectual ability in general. Thus, being aggressive or disruptive might be more likely to impinge upon children's social relationships than on their general learning, which could result in a more specific impairment in verbal skills. We conceived therefore that both accounts, i.e. that behaviour causes cognitive deficits or that cognitive deficits underlie or cause the behaviour, point to the hypothesis that conduct problems would be specifically negatively associated with verbal ability, independently of hyperactivity, but that no other independent associations between conduct problems and cognition would emerge.

Hyperactivity, on the other hand, we proposed would be significantly negatively associated with all aspects of cognition (verbal ability, non-verbal IQ, theory of mind and inhibitory control), even after controlling for co-morbid conduct problems. This was based both on the notion that the hyperactivity results from an underlying general cognitive vulnerability (Nigg & Huang-Pollock, 2003), and the likelihood that hyperactive behaviour would be likely to interfere with learning and task performance in general, such that the association could be transactional in nature.

3.1.4 Comparison of chapter 2 categorical analyses with chapter 3 dimensional analyses

Our findings in the extremes analyses reported in chapter 2 were consistent with the above hypothesis with regard to high levels of conduct problems (i.e. a specific cognitive deficit in verbal ability). Our hypothesis for this chapter therefore extends Nigg and Huang-Pollock's (2003) theory to apply to wider variations in levels of conduct problems and hyperactivity, such as those seen across the present community sample. We proposed therefore that a specific verbal deficit would not only apply to extreme levels of conduct problems above a given threshold, as seen in chapter 2, but that verbal ability and conduct problems would be negatively associated dimensionally across the whole sample.

Previous studies which have analysed the associations between behaviour and cognition in categorical and dimensional analyses have found that similar associations are evident at extreme ends of the distribution to those found across the whole sample (e.g. Plomin et al, 2002). This offers us further reason to hypothesise that verbal ability (but not non-verbal ability, theory of mind or inhibitory control) would be significantly negatively associated with conduct problems in the whole-sample analyses of the present chapter. Such a finding would support theories implicating the same causal or associated cognitive processes in models of both clinical-level conduct problems (such as conduct disorder or ODD) and conduct problems across the whole behavioural spectrum (including children with no conduct problems or low-level, occasional management difficulties).

3.1.5 Summary of chapter 3 aims and hypotheses

- Conduct problems will be significantly negatively associated with verbal ability and this association will remain significant when controlling for hyperactivity.
- Any other significant associations between conduct problems and cognition (e.g. non-verbal IQ, theory of mind or inhibitory control) will no longer remain significant when controlling for hyperactivity.
- Hyperactivity will be significantly negatively associated with verbal ability, non-verbal IQ, theory of mind and inhibitory control. These associations will remain significant when controlling for conduct problems.

3.2 Method

3.2.1 Design and participants

This chapter is concerned with the whole sample of 218 children (105 boys and 113 girls) described in detail in chapter 2. The study design and recruitment procedure are also detailed in chapter 2.

3.2.2 Measures

All measures are as reported in section 2.2.5 of chapter 2.

3.2.3 Analyses

Firstly, Pearson's correlations between the parent- and teacher-rated SDQ conduct problems sub-scales, the parent and teacher-rated SDQ hyperactivity sub-scales, and the HBRS experimenter-rated measure of hyperactivity were conducted. This was to establish in the first instance the extent of association between conduct problems and hyperactivity in the present sample, and to thereby clarify the need to control for the other aspect of behaviour in subsequent analyses which focussed on one or other element of behaviour.

Secondly, Pearson's correlations between parent and teacher-rated conduct problems and verbal ability and non-verbal IQ were conducted, as well as between parent, teacher and experimenter-rated hyperactivity and verbal ability and non-verbal IQ.

In order to determine which aspect of cognition contributed unique variance to conduct problems or hyperactivity, separate linear regression models were used with each measure of conduct problems or hyperactivity as the dependent variable in each model. Verbal ability was entered at step 1, followed by non-verbal IQ at step 2. In the next equation the steps were switched, such that non-verbal IQ was entered at step 1 and verbal ability at step 2. Step 2 determined the proportion of unique variance in the dependent variable accounted for by the particular aspect of cognition, independently of the other aspect of cognition.

Next, linear regression analyses with parent and then teacher-rated conduct problems as the dependent variable were conducted, entering hyperactivity (parent, teacher and experimenter-rated in one step) at step 1, followed by verbal and non-verbal ability at step 2. This was to determine whether these aspects of cognition still accounted for a significant proportion of the variance in conduct problems, independently of hyperactivity. The equivalent set of regression analyses was then conducted with parent, teacher and experimenter-rated hyperactivity as dependent variables, entering (parent and teacher-rated) conduct problems at step 1, and verbal and non-verbal ability at step 2.

Following the regression analyses, Pearson's correlations were run to determine the associations between ToM, IC, verbal ability and non-verbal IQ. These analyses formed the rationale for controlling for verbal ability and non-verbal IQ in the following analyses.

Next, Pearson's correlations between parent and teacher rated conduct problems and ToM and IC, and between parent, teacher and experimenter-rated hyperactivity and ToM and IC were conducted. Any significant associations were entered into regression models with conduct problems or hyperactivity as dependent variables, and ToM entered at step 1, IC at step 2 and then the steps reversed to determine which aspect of cognition accounted for unique variance independently of the other.

The next set of analyses aimed to determine the extent to which ToM and IC predicted unique variance in conduct problems or hyperactivity, independently of verbal and non-verbal ability, and independently of conduct problems or hyperactivity. To address this issue, the different ratings of conduct problems and hyperactivity were entered separately as dependent variables, with non-verbal IQ and verbal ability entered at step 1 (together in one step), followed by ToM and IC entered at step 2. In the next set of regression equations, the following procedure was employed. With conduct problems as the dependent variable, hyperactivity (parent, teacher and experimenter-rated hyperactivity all in one step) was entered at step 1. ToM and IC were then entered at step 2. With hyperactivity as the dependent variable, conduct problems (parent and teacher-rated conduct problems together in one step) were entered at step 1, followed by ToM and IC at step 2.

3.3 Results

3.3.1 Associations between conduct problems and hyperactivity

Table 3.1 details the Pearson's correlations between both ratings of conduct problems (parent and teacher) and all ratings of hyperactivity (parent, teacher and experimenter). All ratings were significantly positively associated, indicating that in general high hyperactivity ratings corresponded with high conduct problems ratings. All associations were weak to moderate in magnitude (in accordance with Cohen's (1988) criteria, i.e. r<.5 = small/ modest, r>/=.8 = large, in between = moderate).

The strongest associations were those completed by the same rater. Thus, teacher-rated conduct problems and teacher-rated hyperactivity were correlated moderately (r=.61, p<0.001). This indicates that teacher rated conduct problems and teacher rated hyperactivity had 37% of variance in common. Parent-rated conduct problems and parent-rated hyperactivity were less strongly correlated at r=.39, p<0.001, and with 15% of variance in common, indicating that whilst a child rated by their parent as being hyperactive was also likely to be rated by their parent as having conduct problems, this association was weaker than that of teacher ratings. Thus, perhaps hyperactivity and conduct problems tend to co-occur in nursery contexts to a greater degree than in other contexts. The weakest association was between parent-rated conduct problems and experimenter-rated hyperactivity (r=.17, p<0.05), with only 3% of variance in common.

Table 3.1: Pearson's correlations between conduct problems and hyperactivity

Measures	Parent hyperactivity	Teacher hyperactivity	Experimenter hyperactivity
Parent conduct	.39*** (N=209)	.25*** (N=162)	.17* (N=202)
Teacher conduct	.23*** (N=162)	.61*** (N=171)	.36*** (N=166)

*p<0.05, ***p<0.001

3.3.2 Associations between conduct problems, hyperactivity, and non-verbal & verbal cognitive ability

Aims and hypotheses: *Conduct problems are proposed to be significantly negatively associated with verbal ability, independently of hyperactivity. Hyperactivity on the other hand is hypothesised to be significantly negatively associated with both non-verbal IQ and verbal ability independently of conduct problems.*

Table 3.2 reveals that parent-rated conduct problems were significantly negatively correlated with verbal ability ($r= -.27$, $p<0.001$), but not non-verbal IQ ($r=-.17$, n.s.), whereas teacher-rated conduct problems were significantly negatively correlated with both non-verbal IQ ($r= -.24$, $p<0.001$) and verbal ability ($r= -.32$, $p<0.001$). This indicates that children with higher levels of conduct problems identified by parental reports also tended to have poorer verbal ability, but not lower non-verbal IQs. Children with higher levels of teacher-rated conduct problems on the other hand were likely to have both poor verbal ability and a low non-verbal IQ. All of the significant associations were relatively weak in magnitude, indicating that the variance in common between conduct problems and cognition was between 6 and 10%.

Table 3.2: Pearson's correlations between conduct problems, hyperactivity, non-verbal IQ and verbal ability

Measure	Non-verbal IQ	Verbal ability
Parent-rated conduct problems	-.17 N=199	-.27*** N=196
Teacher-rated conduct problems	-.24*** N=164	-.32*** N=160
Parent-rated hyperactivity	-.30*** N=199	-.25*** N=196
Teacher-rated hyperactivity	-.37*** N=164	-.38*** N=160
Experimenter-rated hyperactivity	-.27*** N=208	-.29*** N=205

***$p<0.001$

Non-verbal IQ and verbal ability were also significantly negatively correlated with all three ratings of hyperactivity (parent-rated hyperactivity and non-verbal IQ: $r= -.30$, $p<0.001$; parent-rated hyperactivity and verbal ability: $r= -.25$, $p<0.001$; teacher-rated hyperactivity and non-verbal IQ: $r= -.37$, $p<0.001$; teacher-rated hyperactivity and verbal ability: $r= -.38$, $p<0.001$; experimenter-rated hyperactivity and non-verbal IQ: $r= -.27$, $p<0.001$; experimenter-rated hyperactivity and verbal ability: $r= -.29$, $p<0.001$). Thus being rated as hyperactive by parents, teachers and experimenter was associated with having a low non-verbal IQ *and* poor verbal ability. Again, these associations were relatively weak in magnitude, indicating that the variance shared between hyperactivity and cognition was between 6 and 14%.

To further analyse the independent contribution of verbal versus non-verbal IQ to the variance in conduct problems and hyperactivity, 2 sets of regression analyses were calculated (see tables 3.3 and 3.4). In the first set of equations, non-verbal ability was entered at step 1, and verbal ability was entered at step 2. In the second set of equations the order was reversed, with verbal ability entered first and non-verbal ability entered at step 2. This enabled the unique variance explained by verbal ability to be analysed at step 2 of the first set of equations, and the unique variance explained by non-verbal ability to be analysed at step 2 of the second set of equations. With regard to parent-rated conduct problems (table 3.3), step 1 of the first set of analyses was significant (non-verbal ability): R-squared = 0.30, $F(1,194) = 5.94$, Beta = -.17, $p<0.05$. Step 2 was also significant (non-verbal ability, verbal ability): R-squared change = 0.05, F change $(2, 193) = 9.38$, Beta = -.25, $p<0.01$. R-squared change revealed that verbal ability accounted for a further 4.5% of the variance in parent-rated conduct problems once the variance explained by non-verbal ability had been controlled for. Thus, verbal ability uniquely accounted for a significant proportion of the variance in parent-rated conduct problems over and above that explained by non-verbal ability. In the second regression equation regarding parent-rated conduct problems, in which verbal ability was entered at step 1 and non-verbal ability was entered at step 2, Step 1 (verbal ability) was significant: R-squared = 0.07, $F(1, 194) = 15.29$, Beta = -.27, $p<0.001$. Step 2 (verbal ability, non-verbal ability), on the other hand, was not significant: R-squared change = 0.00, F change $(2, 193) = 0.35$, Beta = -.05, n.s. This indicates that non-verbal ability did not account for any unique variance in parent-rated conduct problems once the proportion of variance explained by verbal ability was removed from the equation.

The same pattern emerged with regard to teacher-rated conduct problems. Step 1 of the first equation (non-verbal ability) was significant: R-squared = 0.06, F (1, 158) = 9.67, Beta = -.24, $p<0.01$, as was step 2 (non-verbal ability, verbal ability): R-squared change = 0.05, F change (2, 157) = 9.26, Beta = -.27, $p<0.01$. Thus, 5.2% of the variance in teacher-rated conduct problems was accounted for by verbal ability over and above that accounted for by non-verbal ability. In the second regression equation, step 1 (verbal ability) was significant: R-squared = 0.10, F (1, 158) = 17.94, Beta = -.32, $p<0.001$, whereas step 2 (verbal ability, non-verbal ability) was not significant: R-squared change = 0.01, F change (2, 157) = 1.44, Beta = -.11, n.s. Thus, only a further 0.8% of the variance in teacher-rated conduct problems could be explained by non-verbal ability independently of verbal ability.

Table 3.3: Proportion of variance in conduct problems explained by non-verbal IQ and verbal ability (β, R^2 change)

	Parent conduct		Teacher conduct	
	β	R^2 change	β	R^2 change
Step1: Non-verbal IQ	-.172*	.030*	-.240**	.058**
Step 2: Verbal ability	-.246**	.045**	-.266**	.052**
Step1: Verbal ability	-.270***	.073***	-.319***	.102***
Step 2: Non-verbal IQ	-.047	.002	-.105	.008

*p<0.05; **p<0.01; ***p<0.001

A somewhat different set of findings emerged for hyperactivity (table 3.4). The first equation with regard to parent-rated hyperactivity revealed that step 1 (non-verbal ability) was significant: R-squared = 0.09, F (1, 194) = 18.78, Beta = -.30, $p<0.001$, but that step 2 (non-verbal ability, verbal ability) was not significant: R-squared change = 0.01, F change (2, 193) = 2.61, Beta = -.13, n.s. Verbal ability did not account for a significant proportion of variance (only 1.2%) in parent-rated hyperactivity beyond that accounted for by non-verbal ability. In the second equation, step 1 (verbal ability) was significant: R-squared = 0.06, F (1, 194) = 12.49, Beta = -.25, $p<0.001$, and step 2 (verbal ability, non-verbal ability) was also significant: R-squared change = 0.04, F change (2, 193) = 8.57, Beta = -.23, p<0.01, indicating that non-verbal ability accounted for a further (and significant) 4% of the variance in parent-rated hyperactivity once the variance explained by verbal ability was removed from the equation.

Results for teacher-rated hyperactivity were as follows. In equation 1, step 1 (non-verbal ability) was significant: R-squared = 0.14, F (1, 158) = 25.13, Beta = -.37, p<0.001. Unlike parent-rated hyperactivity, step 2 (non-verbal ability, verbal ability) was also significant: R-squared change = 0.05, F change (2, 157) = 9.61, p<0.01, which reveals that verbal ability explained a further 5% of the variance in teacher-rated hyperactivity independent of the variance explained by non-verbal ability. In equation 2, step 1 (verbal ability) was significant: R-squared = 0.15, F (1, 158) = 26.71, Beta = -.38, p<0.001, and step 2 was also significant: R-squared change = 0.04, F change (2, 157) = 8.18, Beta = -.24, p<0.01. Thus, non-verbal ability also accounted for a significant proportion of the variance (a further 4.2%) over and above that explained by verbal ability. Overall, both verbal and non-verbal ability accounted for significant unique variance in teacher-rated hyperactivity.

Results for experimenter-rated hyperactivity were consistent with findings reported for teacher-rated hyperactivity. In equation 1, step 1 (non-verbal ability) and step 2 (non-verbal ability, verbal ability) were significant. Step 1: R-squared = 0.07, F (1, 202) = 15.89, Beta = -.27, p<0.001; Step 2: R-squared change = 0.03, F change (2, 201) = 6.95, Beta = -.20, p<0.01. In equation 2 both steps were also significant. Step 1 (verbal ability): R-squared = 0.08, F (1, 202) = 18.39, Beta = -.29, p<0.001; Step 2 (verbal ability, non-verbal ability): R-squared change = 0.02, F change (2, 201) = 4.60, Beta = -.17, p<0.05. Verbal ability accounted for a further 2% of the variance in experimenter-rated hyperactivity over and above non-verbal ability, and non-verbal ability accounted for a further 4% of the variance over and above that of verbal ability.

In summary, findings were largely consistent with the hypothesis: Verbal ability accounted for unique, independent variance in parent and teacher-rated conduct problems over and above that explained by non-verbal ability. Non-verbal ability did not explain any further variance in conduct problems independently of non-verbal ability. Unique variance in both teacher and experimenter-rated hyperactivity was accounted for by both verbal and non-verbal ability. Parent-rated hyperactivity followed a somewhat different pattern: non-verbal ability contributed unique variance over and above the effects of verbal ability, but the reverse was not true: verbal ability contributed no unique variance to parent-rated hyperactivity.

Table 3.4: Proportion of variance in hyperactivity explained by non-verbal IQ and verbal ability (β, R^2 change)

	Parent hyperactivity		Teacher hyperactivity		Exptr hyperactivity	
	β	R^2 change	β	R^2 change	β	R^2 change
Step1:						
Non-verbal IQ	-.297***	.088***	-.370***	.137***	-.270***	.073***
Step 2:						
Verbal ability	-.128	.012	-.259**	.050**	-.204**	.031**
Step1:						
Verbal ability	-.246***	.060***	-.380***	.145***	-.289***	.083***
Step 2:						
Non-verbal IQ	-.232**	.040**	-.239**	.042**	-.166*	.020*

*p<0.05; **p<0.01; ***p<0.001

In order to further assess the unique predictive power of non-verbal IQ and verbal ability in explaining variance in conduct problems and hyperactivity, some further linear regressions were calculated (tables 3.5 and 3.6). This time the variance accounted for by hyperactivity was controlled for in the association between verbal ability and conduct problems, and the variance accounted for by conduct problems was controlled for in the association between non-verbal ability and parent-rated hyperactivity. Further, the variance accounted for by conduct problems was controlled for in the association between non-verbal and verbal ability and both teacher and experimenter-rated hyperactivity.

Table 3.5 reveals that verbal ability still accounted for significant unique variance in parent-rated conduct problems, but not teacher-rated conduct problems, after controlling for the variance explained by hyperactivity. Specifically, step 1 (parent, teacher and experimenter-rated hyperactivity), with parent-rated conduct problems as the dependent variable, was significant: R-squared = 0.17, F (3, 156) = 1.51, Beta = .34, .12, .04, p<0.001. Step 2 (verbal ability) was also significant: R-squared change = 0.02, F change (4, 155) = 3.94, Beta = -.16, p<0.05. That is to say, a unique (and significant) 2% of the variance in parent rated conduct problems, above and beyond that explained by co-morbid hyperactivity, was accounted for by verbal ability. In contrast, with teacher-rated conduct problems as the dependent variable, step 1 (parent, teacher and experimenter-rated hyperactivity) was significant: R-squared = 0.37, F (3, 156) = 31.06, Beta = .04, 57, .05, p<0.001, but step 2 (verbal ability) was not significant: R-squared change = 0.01, F change (4, 155) = 1.88, Beta = -.10, n.s. This indicates that only a further 0.7% of the variance in teacher-rated conduct problems was accounted for by verbal ability after controlling for the variance explained by co-morbid hyperactivity. Thus, the association between parent-rated conduct problems and verbal ability, but not between teacher-rated conduct problems and verbal ability, was independent of hyperactivity.

Table 3.5: Proportion of variance in conduct problems explained by verbal ability (β, R^2 change), after controlling for hyperactivity

	Parent conduct		Teacher conduct	
	β	R^2 change	β	R^2 change
Step1:				
Parent-rated hyperactivity	.343***	.168***	.039	.374***
Teacher-rated hyperactivity	.116		.572***	
Exptr-rated hyperactivity	.038		.046	
Step 2:				
Verbal ability	-.158*	.021*	-.095	.007

*p<0.05; ***p<0.001

Table 3.6 indicates that all significant associations between hyperactivity and cognition remained significant after controlling for conduct problems, and thus the associations can be considered independent of conduct problems. Step 1 (parent and teacher-rated conduct problems) was significant with parent-rated hyperactivity as the dependent variable: R-squared = 0.17, F (2, 159) = 15.77, Beta = .35, .13, p<0.001. Non-verbal IQ was the only aspect of cognition entered at step 2, since the association between verbal ability and parent-rated conduct problems was not independent of non-verbal IQ. Step 2 was also significant: R-squared change = 0.05, F change (3, 158) = 9.12, Beta = -.22, p<0.01. This illustrates that, above and beyond the variance accounted for by conduct problems, non-verbal IQ explained a further and significant 5% of the variance in parent-rated hyperactivity.

Similarly, with teacher-rated hyperactivity as the dependent variable, step 1 (parent and teacher-rated conduct problems) was significant: R-squared = 0.38, F (2, 157) = 47.28, Beta = 0.74, 0.59, p<0.001. Step 2 (this time with both non-verbal IQ and verbal ability entered) was also significant: R-squared change = 0.06, F change (4, 155) = 8.11, Beta = -.18, -.11, p<0.001. This result indicates that over and above the predictive power of conduct problems, non-verbal and verbal ability accounted for a unique 5.9% of the variance in teacher-rated hyperactivity.

Finally, comparable results emerged with experimenter-rated hyperactivity as the dependent variable. Step 1 (parent and teacher-rated conduct problems) was significant: R-squared = 0.13, F (2, 157) = 11.74, Beta = 0.07, 0.33, p<0.001. Over and above step 1, when non-verbal IQ and verbal ability were entered at step 2, this was also significant: R-squared change = 0.05, F change (4, 155) = 8.20, Beta = -.14, -.12, p<0.05. Therefore, a further 4.5% of the variance in experimenter-rated hyperactivity, over and above that explained by conduct problems, was accounted for by non-verbal and verbal ability.

Table 3.6: Proportion of variance in hyperactivity explained by non-verbal IQ and verbal ability (β, R^2 change), after controlling for conduct problems

	Parent hyperactivity[A]		Teacher hyperactivity		Experimenter hyperactivity	
	β	R^2 change	β	R^2 change	β	R^2 change
Step1:						
Parent-rated conduct	.350***	.166***	.074	.376***	.069	.130***
Teacher-rated conduct	.128		.587***		.334***	
Step 2:						
Non-verbal IQ	-.221**	.046**	-.183**	.059***	-.136	.045*
Verbal ability	--		-.113		-.124	

*p<0.05; **p<0.01; ***p<0.001
[A] only NVIQ at step 2

Summary of results: *Results were largely consistent with the hypotheses. Conduct problems were predominantly associated with verbal ability over non-verbal ability. Hyperactivity was associated and with both non-verbal and verbal ability according to teacher and experimenter reports, and predominantly with non-verbal ability over verbal ability according to parent reports. Controlling for hyperactivity, the association between verbal ability and parent-rated conduct problems, but not* *teacher-rated conduct problems, remained significant. All significant associations between hyperactivity and cognition remained significant when controlling for the variance accounted for by conduct problems.*

3.3.3 Associations between conduct problems, hyperactivity and theory of mind & inhibitory control

Aims and hypotheses: *Conduct problems are not expected to be significantly associated with ToM or IC independently of hyperactivity. In contrast, we predict that hyperactivity will be significantly negatively associated with both ToM and IC, even after controlling for the variance explained by conduct problems.*

Table 3.7 illustrates the extent to which both theory of mind and inhibitory control are significantly positively associated with non-verbal IQ and verbal ability. That is to say, having a high non-verbal IQ and good verbal ability is associated with performing well on theory of mind and inhibitory control tasks. All associations were relatively small in magnitude, with r ranging from .26 through to .36, indicating that ToM and IC have around 7 – 13% of variance in common. For this reason, in calculating the associations between theory of mind and inhibitory control and the behavioural measures, regression equations controlling for verbal and non-verbal ability will be included.

Table 3.7: Pearson's correlations between theory of mind, inhibitory control, IQ and verbal ability *(and partialled for non-verbal IQ and verbal ability)*

Measure	Non-verbal IQ◊	Verbal ability◊◊	ToM
ToM	.26*** *(.11)* N=199	.34*** *(.26***)* N=198	
IC	.32*** *(.19**)* N=199	.36*** *(.24**)* N=198	.46*** *(.37***)* N=200

*p<0.05; **p<0.01; ***p<0.001
◊Only partialled for verbal ability; ◊◊Only partialled for non-verbal IQ

Table 3.8 reveals that neither ToM nor IC were significantly associated with conduct problems across the sample as a whole. However, both teacher-rated hyperactivity and experimenter-rated hyperactivity were significantly negatively associated with both ToM and IC, though the associations were relatively weak in magnitude, with r ranging from -.25 (teacher-rated hyperactivity and IC, and experimenter-rated hyperactivity and ToM) to -.33 (experimenter-rated hyperactivity and IC). This suggests that ToM and IC share around 6 – 11% of variance in common with hyperactivity. Whilst the association is modest, it is indicative of a tendency for higher levels of hyperactivity to coincide with poorer scores on ToM and IC measures. Nevertheless, these associations did not extend to parent-rated hyperactivity, which was not significantly associated with ToM or IC. Thus, it seems, the associations may be limited to the nursery context.

Given that, even without controlling for verbal and non-verbal ability or hyperactivity, no significant associations emerged between conduct problems and ToM or IC, or between parent-rated hyperactivity and ToM or IC, no further analyses were carried out with conduct problems or parent-rated hyperactivity as dependent variables.

Table 3.8: Pearson's correlations between conduct problems, hyperactivity, theory of mind and inhibitory control

Measure	ToM	IC
Parent-rated conduct problems	-.13 N=192	-.12 N=192
Teacher-rated conduct problems	-.09 N=156	-.19 N=156
Parent-rated hyperactivity	-.08 N=192	-.17 N=192
Teacher-rated hyperactivity	-.26*** N=156	-.25*** N=156
Experimenter-rated hyperactivity	-.25*** N=200	-.33*** N=200

***$p<0.001$

Table 3.9 details the regression equations for the associations between teacher and experimenter hyperactivity and ToM and IC, with ToM entered at step 1 in the first set, and IC entered at step 1 in the second set. Results revealed that both aspects of cognition contributed unique and significant (or at least approaching significant) variance to teacher- and experimenter-rated hyperactivity. Both ToM and IC contributed a similar proportion of variance to teacher-rated hyperactivity: Step 1 (ToM): R-squared = 0.07, F (1, 154) = 11.11, Beta = -.26, p<0.001, step 2 (ToM, IC): R-squared change = 0.02, F change (2, 153) = 3.64, Beta = -.17, p=0.058. Thus, step 2 (IC entered last) reveals that the unique contribution of IC to explaining the variance in teacher-rated hyperactivity approaches significance, accounting for 2.2% of the variance independently of ToM. With the steps reversed the following results emerged: Step 1 (IC): R-squared = 0.06, F (1, 154) = 10.24, Beta = -.25, p<0.01; step 2 (IC, ToM): R-squared change = 0.03, F change (2, 153) = 4.47, Beta = -.18, p<0.05. Although the independent contribution of ToM was significant, with 2.7% of the variance in teacher-rated hyperactivity uniquely accounted for, it was comparable to the 2.2% of variance accounted for by IC.

One of the aspects of cognition did emerge as a stronger predictor of experimenter-rated hyperactivity, however. With ToM entered at step 1, step 1 was significant: R-squared = 0.07, F (1, 198) = 13.69, Beta = -.25, p<0.001. Step 2 (ToM, IC) was also significant: R-squared change = 0.06, F change (2, 197) = 12.83, Beta = -.27, p<0.001. This indicates that over and above the variance accounted for by ToM, IC explained a further 6% of the variance in experimenter-rated hyperactivity. With the steps reversed, it was revealed that, independently of IC, ToM did not independently account for such a large proportion of variance in experimenter-rated hyperactivity, Step 1 (IC) was significant: R-squared = 0.11, F (1, 198) = 24.04, Beta = -.33, p<0.001. Step 2 approached significance: R-squared change = 0.01, F change (2, 197) = 3.06, Beta = -.13, p=0.082. Only 1.4% of the variance in experimenter-rated hyperactivity was uniquely explained by ToM, though this approached statistical significance. Thus, both ToM and IC significantly predicted both teacher and experimenter-rated hyperactivity.

Table 3.9: Proportion of variance in teacher and experimenter-rated hyperactivity explained by ToM and IC (β, R^2 change)

	Teacher hyperactivity		Experimenter hyperactivity	
	β	R^2 change	β	R^2 change
Step1: ToM	-.259***	.067***	-.254***	.065***
Step 2: IC	-.166†	.022†	-.269***	.057***
Step1: IC	-.250**	.062**	-.329***	.108***
Step 2: ToM	-.184*	.027*	-.131†	.014†

† non-significant trend (p<0.10); *p<0.05; **p<0.01; ***p<0.001

The next set of regression equations (table 3.10), were concerned with the extent to which ToM and IC would still account for a significant proportion of the variance in teacher and experimenter-rated hyperactivity, after taking into account the variance explained by verbal and non-verbal ability. ToM and IC were entered together as one step given that both aspects of cognition explained significant or approaching significant variance in teacher and experimenter-rated hyperactivity. Table 3.10 illustrates that ToM and IC only accounted for unique variance in experimenter-rated hyperactivity, not teacher-rated hyperactivity, when verbal ability and non-verbal IQ were taken into account.

Thus, with teacher-rated hyperactivity as the dependent variable and verbal ability and non-verbal IQ entered at step 1, step 1 was significant: R-squared = 0.19, F (2, 153) = 17.59, Beta = -.26, -.24, p<0.001, whereas step 2 (ToM, IC) was not significant: R-squared change = 0.02, F change (4, 151) = 1.53, Beta = -.11, -.06, n.s. In contrast, with experimenter-rated hyperactivity as the dependent variable, both steps were significant: Step 1 (verbal ability, non-verbal IQ): R-squared = 0.10, F (2, 195) = 11.31, Beta = -.20, -.17, p<0.001; step 2 (ToM, IC): R-squared change = 0.05, F change (4, 193) = 9.07, Beta = -.09, -.21, p<0.01. Specifically, IC and ToM only explained a further 1.6% of the variance in teacher-rated hyperactivity once verbal ability and non-verbal ability were accounted for, whereas they explained a unique 5.4% of the variance in experimenter-rated hyperactivity, over and above that accounted for by verbal and non-verbal ability. This indicates that it could be intellectual ability in general, rather than ToM and IC specifically, that is associated with teacher-rated hyperactivity, whereas there does seem to be an independent association between IC and ToM (though predominantly IC) and experimenter-rated hyperactivity.

Table 3.10: Proportion of variance in teacher and experimenter-rated hyperactivity explained by ToM and IC (β, R^2 change), after controlling for verbal ability and non-verbal IQ

	Teacher hyperactivity		Experimenter hyperactivity	
	β	R^2 change	β	R^2 change
Step1:				
Verbal ability	-.259**	.187***	-.204**	.104***
Non-verbal IQ	-.239**		-.166*	
Step 2:				
ToM	-.106	.016	-.087	.054**
IC	-.055		-.207**	

*p<0.05; **p<0.01; ***p<0.001

Finally, we ran a further regression equation to address the issue of comorbid conduct problems, and whether this might better account for the association between ToM and IC and teacher and experimenter-rated hyperactivity. Table 3.11 demonstrates that the associations between ToM and IC and teacher and experimenter-rated hyperactivity were independent of the variance accounted for by conduct problems. Thus, over and above step 1 (parent and teacher-rated conduct problems), step 2 (ToM, IC) was significant for both teacher-rated hyperactivity: R-squared change = 0.04, F change (4, 151) = 5.42, Beta = -.18, -.05, p<0.01, and experimenter-rated hyperactivity: R-squared change = 0.08, F change (4, 151) = 7.75, Beta = -.13, -.21, p<0.001. 4.2% of the variance in teacher-rated hyperactivity, and 8.1% of the variance in experimenter-rated hyperactivity, were uniquely accounted for by IC and ToM.

Table 3.11: Proportion of variance in teacher and experimenter-rated hyperactivity explained by ToM and IC (β, R^2 change), after controlling for conduct problems

	Teacher hyperactivity		Experimenter hyperactivity	
	β	R^2 change	β	R^2 change
Step1:				
Parent-rated conduct	.074	.376***	.069	.130***
Teacher-rated conduct	.587***		.334***	
Step 2:				
ToM	-.179*	.042**	-.128	.081***
IC	-.051		-.209*	

*p<0.05; **p<0.01; ***p<0.001

Summary of results: *In line with predictions, ToM and IC were not significantly associated with conduct problems. Teacher and experimenter-rated hyperactivity emerged as significantly negatively correlated with both ToM and IC, and these associations were independent of conduct problems, as predicted. Nevertheless, parent-rated hyperactivity was not significantly associated with ToM or IC. Only the association between experimenter-rated hyperactivity and ToM and IC remained significant when controlling for non-verbal IQ and verbal ability.*

3.3.4 Comparison of chapter 2 categorical analyses with chapter 3 dimensional analyses with regard to conduct problems

Objectives and hypotheses: *To determine whether results found at extreme ends of the behavioural distribution with regard to conduct problems would also be found across the sample as a whole, in terms of associations between conduct problems and various aspects of cognitive functioning (non-verbal IQ, verbal ability, ToM and IC).*

Table 3.12 summarises the results from chapters 2 and 3 side-by-side. Chapter 2 was concerned with mean differences between scores on verbal ability, non-verbal ability, ToM and IC measures in children with high levels of conduct problems identified by parents and/or teachers, and control children with low levels of conduct problems. Chapter 3 on the other hand was concerned with correlations between the measures and conduct problems, and was also able to distinguish between parent and teacher-rated conduct problems. Since the "at risk" group was made up of children rated by parents and/ or teachers, no such distinction was made between parent and teacher-rated conduct problems. For these reasons, it was not possible to directly compare the results due to the different analytical methods used, therefore table 3.12 merely indicates whether an effect for the given measure in association with conduct problems was present.

With regard to the association between non-verbal IQ and conduct problems, chapter 2 categorical analyses of "at risk" versus "low risk" children (with high versus low levels of conduct problems) indicated no significant difference between the mean score for NVIQ in the "at risk" group compared with the "low risk" group. Dimensional analyses in chapter 3, on the other hand, revealed that across the sample as a whole, parent-rated conduct problems showed no significant association with non-verbal IQ, whilst teacher-rated conduct problems were significantly negatively associated with non-verbal IQ.

Verbal ability was reported to be significantly higher in "at risk" than "low risk" children in chapter 2, and consistent with this across the sample as a whole (chapter 3), both parent and teacher-rated conduct problems were significantly negatively associated with verbal ability.

The "at risk" and "low risk" children did not differ in their performance on tasks measuring ToM and IC ability. In line with this finding, variations in levels of conduct problems across the whole sample were not significantly associated with variations in levels of ToM or IC ability.

Table 3.12: Associations between conduct problems and non-verbal ability, verbal ability, ToM and IC in categorical analyses versus dimensional analyses

Measure	Categorical (chapter 2)	Dimensional (chapter 3)	
Non-verbal IQ	x	P	x
		T	√
Verbal ability	√	P	√
		T	√
ToM	x	P	x
		T	x
IC	x	P	x
		T	x

x = No significant mean difference between "at risk" and "low risk" on measure (categorical) or no significant correlation between conduct problems and measure (dimensional)

√ = Significant mean difference between "at risk" and "low risk" on measure (categorical) or significant correlation between conduct problems and measure (dimensional)

Trend = Trend towards mean difference between "at risk" and "low risk" on measure (categorical) or trend towards correlation between conduct problems and measure (dimensional)

Summary of results: *Results pertaining to chapter 2 categorical analyses were largely consistent with findings across the whole sample in the present chapter with regard to conduct problems. The exception to this was that the "at risk" group and the "low risk" group did not differ significantly in terms of non-verbal IQ, whereas when analysed across the whole sample it emerged that teacher but not parent-rated conduct problems were significantly negatively associated with non-verbal ability. Verbal ability differentiated the "at risk" from the "low risk" group in being significantly lower in the "at risk" group, and in line with this, across the sample as a whole, verbal ability was significantly negatively associated with both parent and teacher rated conduct problems. ToM and IC did not differentiate the two "risk" groups, nor did they emerge as being significantly correlated with conduct problems across the whole sample.*

3.4 Discussion

3.4.1 Associations between conduct problems, hyperactivity, non-verbal IQ and verbal ability at age 3

Results revealed that, consistent with the hypothesis, verbal ability but not non-verbal ability predicted unique variance in parent and teacher-rated conduct problems. The association between parent-rated conduct problems and verbal ability was independent of the variance explained by hyperactivity. Also in line with the hypothesis was the fact that teacher and experimenter-rated hyperactivity were uniquely predicted by both verbal and non-verbal ability. Parent-rated hyperactivity was only independently predicted by non-verbal ability however, in contrast to the results for conduct problems. All significant associations between hyperactivity and cognition remained significant when controlling for the variance accounted for by conduct problems, as predicted.

Hinshaw (1992) proposed that hyperactivity is more strongly associated with cognitive impairments than conduct problems. The present study is consistent with this notion in that hyperactivity emerged as being associated with a more pervasive profile of cognitive impairment than conduct problems, across both verbal and non-verbal abilities.

Why should hyperactivity be associated with a more pervasive pattern of cognitive impairment than conduct problems? If hyperactivity is characterised as a disorder of neuro-developmental origins (Hinshaw, 1992), then it follows that a more generalised pattern of cognitive impairment might be likely to underlie the difficulties. This would be consistent with Goodman et al's (1995) "IQ is a cause" hypothesis. Adhering to the "IQ is a consequence" account (Goodman et al, 1995), one might contest that the hyperactive and inattentive behaviour interferes with cognitive development and performance across the range of verbal and non-verbal functions. Conduct problems on the other hand might be expected to interfere more strongly with cognitive processes which are more important in the social domain, given that the behaviour is characterised by its anti-social profile. Thus, language and communication skills would be more likely to be compromised as a result of conduct problems. Other theorists arguing from the "cognitive ability is a cause" perspective (Goodman et al, 1995), have proposed that specific verbal deficits might underlie and cause conduct problems. Gilmour et al (2004), for example, found pragmatic language impairments in children with conduct disorder and in a sub-set of antisocial children excluded from school, which were as severe as those found in children with autism. The authors argued that the mechanism by which such a language impairment might impact upon behaviour could be via inappropriate use or interpretation of language, which could be misconstrued as rudeness. It is also possible that misinterpreting others' attempts at communication, coupled with a lack of understanding about why their own attempts at communication are often met with hostility, could result in children turning to antisocial behaviour out of a sense of injustice or disillusionment.

The fact that conduct problems and hyperactivity appear to be associated with slightly different cognitive processes is consistent with the proposal that although conduct problems and hyperactivity are highly co-morbid conditions, at least with regard to clinical-level impairments (DSM-IV; APA, 1994), they are separate phenomena with different cognitive correlates. Thus, the findings support the notion of analysing and considering conduct problems as a separate construct from hyperactivity. This contention is to some degree corroborated by genetic studies in which, overall, the two behavioural profiles have emerged as differentially associated with genetic influences (Rutter et al, 1999), with hyperactivity showing directly heritable and relatively strong genetic risk (e.g. Goodman & Stevenson, 1989), and conduct problems resulting to a large extent from environment x gene interactions (e.g. Bohman, 1996).

For parent-rated conduct problems at least, the negative association with verbal ability remained significant when controlling for hyperactivity. Therefore, whilst the cognitive impairment does not appear to be as pervasive as that associated with hyperactivity, this result speaks against the view that only by virtue of co-occurring hyperactivity are conduct problems associated with any type of cognitive impairment (Hinshaw, 1992).

It is hard to comprehend, nevertheless, why this specific verbal association should relate only to parent-rated conduct problems but not teacher-rated conduct problems. Whilst to some degree having collected multiple ratings of behaviour makes the pattern of results rather complicated and somewhat inconsistent, since invariably a greater variation in the findings is afforded by collecting more than one person's opinion about the child's behaviour, this cautious approach to data collection has its merits. Clearly collecting data from just one informant, as many studies have done, would not offer a complete picture about the child's behaviour in different contexts or according to different sources. If the pattern of results is inconsistent between multiple informants, then caution is urged in interpreting the findings with regard to one rater as applying to hyperactivity or conduct problems in general. Consistent findings, on the other hand, in which significant associations emerge for all ratings of behaviour, suggest a strong and robust effect.

3.4.2 Associations between conduct problems, hyperactivity, theory of mind and inhibitory control at age 3

Across the sample as a whole, performing well at theory of mind tasks and at tasks measuring inhibitory control, was not associated with having lower levels of conduct problems. In contrast, it emerged that teacher-rated hyperactivity and experimenter-rated hyperactivity were significantly negatively associated with both ToM and IC, and this association was independent of conduct problems, i.e. specific to the hyperactive behavioural profile. This finding is consistent with Hughes et al's (1998) findings, though this study was concerned with extreme levels of hyperactivity rather than a whole sample dimensional measure. In this study, "hard to manage" boys and girls at pre-school age, selected for the presence of hyperactivity over a given threshold, could be differentiated from control children in their significantly poorer profile on theory of mind and inhibitory control tasks. Other theorists have implicated inhibitory control deficits in the development and maintenance of ADHD (e.g. Barkley, 1997). However, the present findings extend the theories based on clinical or "at risk" groups, to apply to a wider range of variations in levels of hyperactivity, across the whole sample. Thus, it seems that perhaps Barkley's (1997) inhibition theory of ADHD is not limited to children with clinical levels of hyperactivity, and that processes underlying the development of clinically significant hyperactive behaviour such as ADHD are also responsible for the variations in hyperactivity levels across the spectrum of the whole population. This could be due to the hyperactivity impacting on the performance on tasks measuring ToM and IC, or alternatively due to pre-frontal deficits responsible for neuropsychological impairment (Channon & Crawford, 2000) also causing hyperactive behaviour.

This is not the first study to document a differential association with ToM in children with conduct problems and hyperactivity. Consistent with the present findings, Buitelaar et al (1999) documented that children with ADHD showed deficits in ToM competency whereas children with conduct problems did not present with such a deficit. However, again this study was concerned with children with extreme levels of both hyperactivity and conduct problems, and older children (aged between 8 and 18 years). Whatever the explanations for the associations between hyperactivity and ToM and IC, why might ToM and IC be significantly negatively associated with hyperactivity yet not with conduct problems? One tenable assertion is that conduct problems are associated with ToM and IC deficits, but not until later in development once problems have been present for longer (Nigg & Huang-Pollock, 2003). Thus, given time it is possible that conduct problems interfere with the capacity to understand others' minds and to inhibit dominant responses due to the impact of their behaviour on their social relationships. Children who behave aggressively towards their peers, parents or teachers may only experience negative social reactions from others, which could impact upon their mental representations of the intentions and beliefs of others in the form of a skewed theory of mind, or theory of "nasty" minds (Happé & Frith, 1996). However, it is also possible that clinical levels of conduct problems are also necessary to impact upon ToM and IC competency, and that even in an older sample we may not have seen an association due to the inclusion of children with low levels of conduct problems in the analyses. The findings do seem to suggest that, at least this early in development, children's conduct problems are not preceded and/or caused by a delay in the capacity to appreciate the perspectives of others or to prevent themselves from exhibiting non-desired but pre-potent responses. Frontal theories of the development of hyperactivity (Raine, 2002) may not be so easily applied to conduct problems. This might open up the possibility of perhaps a more social route to conduct problems (as suggested by Rutter et al, 1999), at least at this stage of development.

However, parent-rated hyperactivity was not associated with a deficit in ToM and IC. In accordance with a theory implicating ToM or IC impairments in a causal role in the development and maintenance of hyperactivity, it may be the case that due to frontal lobe impairments children engage in hyperactive behaviour, either as a direct result of the brain dysfunction, or via frustrations brought about by the difficulties in social understanding and response inhibition, and that the nursery environment is one most likely to trigger such a behavioural response because of the increased demand on both ToM and IC skills in the nursery setting. This also extends previous research, in suggesting that cognitive deficits could underlie hyperactive behaviour in certain contexts but not others. One potential implication of such a finding is that a hyperactive child could benefit from adaptations to their environment, making it perhaps less distracting or avoiding large crowds of people.

The negative associations between theory of mind and inhibitory control and teacher-rated hyperactivity no longer reached significance when the shared variance with non-verbal IQ and verbal ability was controlled for. Thus having poor non-verbal IQ and poor verbal ability is associated with being hyperactive in nursery, possibly because the nursery environment might be more frustrating to a child with poor verbal skills and low intellectual ability and thus more likely to lead to hyperactive behaviour. In a similar way, a child with poorer cognitive ability might have a lower capacity for performing well at theory of mind and inhibitory control tasks, particularly in a setting in which they are distracted and hyperactive. The association between neuropsychological task performance and nursery-based hyperactivity might therefore be mediated in the above way by verbal and non-verbal intellectual ability, such that the association does exist but is not direct or independent of other cognitive processes.

The association between ToM and IC and experimenter-rated hyperactivity, on the other hand, was independent of non-verbal and verbal ability. This finding is difficult to explain, since the experimenter rated the child's behaviour in the same setting as teachers, i.e. in the nursery. One might argue that since the experimenter administered the ToM and IC tasks *and* rated behaviour, that the child's performance on these tasks might have influenced their behaviour ratings. Indeed, the correlation between experimenter-rated hyperactivity and IC was stronger than the other ratings of hyperactivity. One way of avoiding this issue might have been for the experimenter to rate the child's behaviour during an observational session in the nursery, on an occasion separate from the testing situation. Nevertheless, if the child's task performance was influencing the experimenter's ratings of behaviour, it is difficult to explain why this would apply to IC specifically, and not to non-verbal ability for example.

Alternatively, it could be suggested that hyperactive behaviour specifically in the testing situation would of course be more strongly associated with task performance than hyperactivity in the nursery in general, since that particular episode of hyperactivity would have affected the child's task performance. By the same token however, why would the behaviour impact upon IC performance specifically? The finding does offer some support for the notion that IC could represent a core deficit in hyperactivity which is not primarily due to a general low intelligence (Barkley, 1997), though this has not been shown consistently across every rating of hyperactivity.

3.4.3 Comparison of findings from chapter 2 categorical analyses and chapter 3 dimensional analyses

It was of interest in the present study to ascertain the extent to which associations found in our categorical analyses relating to conduct problems in chapter 2 would be comparable to associations seen across the wider variations in conduct problems in our dimensional analyses in this chapter. Previous studies which have analysed data both categorically and dimensionally have reported that findings from the extremes analyses have also been found across the sample as a whole, with regard to verbal and non-verbal ability in association with behaviour problems. Goodman et al (1995), for example, reported that child IQ in a sample of 13-year-old twins was significantly negatively associated with parent and teacher ratings of conduct problems and hyperactivity, and that at extreme ends of the distribution with regard to cognitive impairment, the group with cognitive impairment showed significantly higher levels of parent and teacher-rated conduct problems and hyperactivity than the group without cognitive impairment. Furthermore, Plomin et al (2002) found modest negative associations in their sample of 2, 3 and 4 year old children, between verbal and non-verbal cognitive ability and parent-reported behaviour problems both across the whole sample and when children with impairments in cognitive functioning were analysed in comparison to controls.

The present study was concerned with extreme levels of conduct problems as opposed to extreme levels of cognitive impairment, and therefore it was of interest whether similar patterns of association would be found across dimensional and categorical aspects of our measure of conduct problems. In addition to investigating the extent to which extreme and dimensional conduct problems overlapped with regard to associated non-verbal and verbal ability, it was also of interest how comparable the two sets of analyses would be in relation to associated ToM and IC competencies.

Firstly with regard to non-verbal IQ, no significant differences were reported between the "at risk" group and the "low risk" group in the categorical analyses. In the dimensional analyses, however, looking at the whole range of conduct problems in the sample, no significant correlation emerged between parent-rated conduct problems and non-verbal IQ, whilst there was a significant negative correlation between teacher-rated conduct problems and non-verbal IQ. However, the association between non-verbal ability and conduct problems in the dimensional analyses was not independent of the variance explained by hyperactivity. This suggests that it is hyperactivity, rather than conduct problems which is associated with non-verbal ability (Hinshaw, 1992).

Our findings with regard to verbal ability across both the categorical and the dimensional chapters seem to be the important ones. Verbal ability emerged as the overriding cognitive ability negatively associated with both extreme levels of conduct problems and across the range of conduct problems seen across the whole sample. This extends previous findings pertaining to a specific verbal deficit in severe antisocial behaviour (Moffitt, 1990) to apply to variations in levels of conduct problems which span a more normative range of behaviours, and also extends the finding downwards in age, to apply to pre-school children. Thus, the same underlying mechanisms or associated deficits of severe antisocial behaviour in older children could apply to very mild antisocial behaviour, and even that shown by very young children. This might imply, for example, that interventions that help a child communicate could improve verbal skills and thus lessen the frustrations that lead them to behave aggressively, and this strategy would apply to young offenders as well as 3-year-olds with occasional temper tantrums. Such early intervention programmes could even help prevent later more extreme antisocial behaviour.

Both theory of mind and inhibitory control presented with a consistent pattern of association with conduct problems across the sample as a whole and with regard to extremely high versus low levels of conduct problems, in that no association was evident. Thus, poor theory of mind and low inhibitory control competency were not associated with higher levels of conduct problems overall, and were not characteristic of children with high versus low levels of conduct problems. Thus, if ToM and IC deficits do characterise conduct problems as has been suggested in a number of studies (Giancola et al, 1998; Seguin et al, 1999), this may be due to the fact that the children were older. This could mean that the children in these studies presented with established conduct problems, or conduct problems that were present at a later and more influential stage in their development, so as to have sufficient impact upon neuropsychological development and functioning (Nigg & Huang-Pollock, 2003). In the case of Hughes et al (1998), the children were in fact pre-school age, yet the associations with ToM and IC could have been due to the fact that these children were selected for the presence of high levels of hyperactivity rather than conduct problems. The findings from the categorical and dimensional analyses taken together speak against a frontal deficit underlying the onset of conduct problems at least in pre-school children (Raine, 2002).

3.5 Chapter summary

- As hypothesised, hyperactivity was associated with a more pervasive profile of impairment than conduct problems. Poor verbal ability, but not non-verbal ability, ToM or IC, predicted conduct problems. The association between parent-rated conduct problems and verbal ability was independent of hyperactivity.
- Hyperactivity on the other hand was significantly negatively associated with verbal ability, non-verbal ability, ToM and IC, independently of conduct problems. However, this profile of impairment was only applicable to hyperactivity in the nursery context. Parent-rated hyperactivity was specifically and independently associated with non-verbal ability.
- Findings with regard to conduct problems in this dimensional, whole sample chapter largely replicated findings in the categorical analyses in chapter 2. Verbal ability emerged as specifically associated with conduct problems, and this applied to conduct problems as a dimension, across the wide variation of behaviour displayed by the whole sample, and to particularly high levels of conduct problems indicative of risk.

4

The "at risk" group a year on: Longitudinal categorical analyses

4.1 Overview of the literature and chapter aims and hypotheses

In chapter 2, a group of "at risk" children were identified with conduct problems above the population 90th percentile on the SDQ (Goodman, 1997) according to parents and/ or teachers, alongside a group of "low risk" children for whom parents and teachers reported no significant conduct problems. We reported that the "at risk" group differed from the "low risk" group across a number of risk factors for persistent and severe conduct problems. They presented with significantly poorer verbal ability, significantly poorer social skills according to both parents and teachers, and significantly higher levels of hyperactivity according to parents, teachers and experimenters than the "low-risk" group. Children presenting with "pervasive" risk for conduct problems fared significantly worse across all of the above risk factors than children with "situational" risk for conduct problems.

When boys and girls within the "at risk" group were compared, it emerged that the girls were significantly better than boys at performing early theory of mind tasks and that the "at risk" boys were significantly more hyperactive than the "at risk" girls. Furthermore, boys tended to have poorer non-verbal cognitive ability than girls although this difference did not quite reach statistical significance. When hyperactivity was controlled for, the mild gender differences in cognitive ability (with regard to ToM and NVIQ) were no longer significant or approaching significance.

The above results were concerned with the children's presentation at age 3. The aim of the present chapter was to determine whether conduct problems at age 3 were stable, and whether the "risk factors" which were characteristic of this group were also stable and therefore could be considered to constitute risk for continuity even in such a young sample. That is, is it possible to determine risk in children as young as age 3, or might the processes involved in the aetiology of conduct problems occur later in development? In addition, would girls and boys identified as "at risk" at age 3 be equally likely to display stable conduct problems between the ages of 3 and 4, and would boys still present with a poorer risk factor profile than girls at age 4? Are these "at risk" children still functioning at a lower level compared to the pre-identified "low risk" group who did not present with conduct problems at age 3?

We considered classifying a group of children "at risk" at age 4 on the basis of their parent and/or teacher SDQ conduct problems ratings, and looking retrospectively at the risk factors they presented with at age 3. This might indeed be an informative approach to use if the sample is followed up at a later date beyond age 4, perhaps into middle childhood or adolescence. However, in the present study a year later (age 4) was not considered a sufficient time lapse or appropriate age group to constitute a meaningful "outcome". That is to say that, at age 4 it would still be unclear which children were truly "conduct disordered", had significant school or relationship problems or had engaged in antisocial or criminal behaviour. The strength of the present study is in its focus on very young children, exhibiting some degree of early "risk" for conduct problems before any such established or serious problems have come to light. The key issue here therefore is to establish the extent to which children at age 3 already presenting with a degree of conduct problems can be deemed "at risk" both in terms of the likelihood that they will continue to present with conduct problems a year later at age 4, and in terms of the stability over the course of the year of the associated "risk factors" which were present at age 3. This can help us to address the important issue of how early in development it might be appropriate to identify children with potentially persistent and severe antisocial developmental trajectories. The issue of the predictive power of risk factors will be addressed with regard to the dimensional measure of conduct problems across the whole sample in chapter 6, although this does not relate specifically to high levels of conduct problems.

4.1.1 "At risk" versus "low risk" children at age 4

The "Waltham Forest Study" (Richman et al, 1982) addressed similar issues to the present study. A "behaviour problem" group and a "control" group of children were identified from a community sample of 3-year-old children based on parental ratings of behaviour on the Behavioural Screening Questionnaire (BSQ, Richman & Graham, 1971) which did not distinguish between conduct problems and hyperactivity. Follow-up of the children a year later revealed that 63% of the behaviour problem group compared with 11% of the control group were still above the cut-off on the BSQ for determining significant behaviour problems. Thus, in this study behaviour problems identified as early as age 3 were predictive of continued behaviour problems a year later. Other results indicated that less marked differences were apparent at age 4 between the behaviour problem and control groups with regard to cognitive functioning than were present at age 3, although there was still a general trend towards poorer performance in the "behaviour problem" group on measures of verbal comprehension, hand-eye co-ordination and perceptual motor abilities. In addition to the above cognitive tasks which were also measured at age 3, the Weschler Preschool and Primary Scale of Intelligence (WPPSI, Weschler, 1974) was introduced at age 4. Boys in the behaviour problem group had significantly lower verbal and performance IQs than boys in the control group, and whilst girls in the behaviour problem group scored consistently lower than girls in the control group the differences were not significant. Results from the Waltham Forest Study therefore suggested that behaviour problems evident in the preschool years could predict the stability of both behaviour and of poor cognitive functioning relative to children without early-onset problems in boys and girls over the course of 1 year, although the magnitude of differences in cognitive functioning across the groups tended to narrow with time, and to be more marked in boys than girls.

As well as predicting that the "at risk" group in the present study would continue to display significant conduct problems at age 4 relative to the "low risk" group, based on Richman et al's (1982) findings, it was also hypothesised that the "at risk" group would sustain a profile of impairment on the risk factors that were evident at time 1, namely poorer verbal ability, poorer social skills, and higher levels of hyperactivity. The reason for such a prediction was by virtue of the impact having such impairments at age 3 would be likely to have on a child's development and functioning in conjunction with early onset behaviour problems. Indeed, Richman et al (1982) demonstrated that, for boys at least, risk factors differentiating the "behaviour problem" group from the "control" group at age 3 continued to do so a year later. Thus, the likelihood that the children would overcome the difficulties and "catch up" with their peers by age 4 was considered minimal.

The "at risk" children presented with significantly poorer social skills at age 3 than the "low risk" children, confirming reported findings that children with conduct problems have difficulties with social interaction, perhaps due to social information processing deficits (Dodge et al, 1990; Webster-Stratton, Reid & Hammond, 2001). Poor social skills at age 3 have been found to be predictive of engagement in criminal activity by early adulthood (Stevenson & Goodman, 2001), and hence the negative impact of early deficits in social functioning seems to begin as early in development as age 3. Therefore it was predicted that the "at risk" children would be likely to continue to display poorer social skills than their "low risk" peers at age 4.

Finally, being hyperactive at the same time as displaying conduct problems has been shown to increase the likelihood of later more serious antisocial behaviour such as violent crime (Babinski et al, 1999), many reasons for which have been proposed, including the "hyperactivity and conduct problems" symptom profile representing a distinct disorder characterised by neuropsychological impairments thought to be heritable in origin and therefore less open to change (Lynam, 1996). Thus one might expect hyperactivity occurring in the context of early conduct problems to show some degree of continuity.

In addition to maintaining the risk profile that was evident at age 3, it was also predicted that the "at risk" group would begin to present with some new impairments at age 4 relative to the "low risk" group. Hughes, Dunn & White (1998) reported that their sample of 4-year-old "Hard to manage" children showed skewed theory of mind in terms of greater accuracy at predicting emotions following a "nasty" than a "nice" surprise, as well as impaired performance on false belief tasks, and impairments on tasks measuring inhibitory control in comparison with comparison children showing no behaviour problems. Inhibitory control has long been associated with hyperactivity (e.g. Barkely, 1997), implicating deficits in frontal lobe regions of the brain thought to be responsible for regulating the capacity to inhibit behaviour, in the onset and maintenance of hyperactivity and ADHD. More recently frontal lobe impairments have been implicated in the development of aggressive and antisocial behaviour (Raine, 2002), and given that theory of mind and inhibitory control are both governed by frontal regions of the brain and both undergo a significant period of development during the pre-school years (Channon & Crawford, 2000), theory of mind deficits have also begun to be considered as correlates of conduct problems which could underlie some of the social problems experienced by children with conduct problems (Hughes et al, 1998).

The "at risk" group in the current study at time 1 could not be differentiated from the "low risk" children in terms of their performance on tasks measuring inhibitory control and theory of mind, but given that both skills are thought to develop substantially at around the pre-school period it was anticipated that emerging deficits in these areas of functioning may not come to light until later in the pre-school period, and hence might be evident by age 4. Indeed, it has been proposed that whereas the link between executive deficits and ADHD may be more direct and hence observable very early on in development, cognitive vulnerability (including executive and verbal deficits according to proponents of this theory) is likely to be mediated by socialisation in the case of conduct problems, and therefore not evident until later in development (Nigg & Huang-Pollock, 2003). "Cognitive vulnerability" may not be directly demonstrable before children can pass standard IC and ToM tasks, yet this does not imply that such vulnerability is not already in place by age 3. Based on Nigg and Huang-Pollock's (2003) conjecture, it was anticipated that at time 2 the cognitive vulnerability contributing to our "at risk" children's adjustment and behaviour problems in the pre-school years would be manifested in terms of a poorer performance on IC and ToM tasks in comparison to "low risk" children.

Given that the "pervasive" group presented with even poorer functioning across all of the above risk factors at age 3 than the "situational" group, and adhering to the conjecture that pervasive conduct problems are more likely to persist and worsen with development than conduct problems which are situational in nature (Loeber, 1990), it was anticipated that the "pervasive" group would continue to display both higher levels of conduct problems and a poorer risk factor profile than the "situational" group at age 4.

4.1.2 Gender differences in the presentation of the "at risk" group at age 4

There were a number of reasons for asserting that girls who had been pre-identified "at risk" for conduct problems at age 3 would display fewer conduct problems at 1 year follow-up than their male counterparts. Firstly, the Waltham Forest Study (Richman et al, 1982) mentioned above, looked prospectively at the developmental trajectories taken by girls and boys with behaviour problems at age 3 (defined as a combination of hyperactive and conduct problem behaviours) and found that boys were twice as likely as girls to still be displaying significant behaviour problems at age 8 (Richman et al, 1982). Secondly, Moffitt's (1993) early-onset/ persistent developmental trajectory has been found to be less common amongst girls (McCabe, Rodgers, Yeh & Hough, 2004). Thirdly, at age 3 the "at risk" girls in the present study presented with significantly lower levels of experimenter-rated hyperactivity than the "at risk" boys. Since more boys than girls in the "at risk" group presented with both conduct problems and hyperactivity, and this is a profile of behavioural symptoms predictive of particularly poor outcome in terms of the likelihood of persistence and severity of conduct problems (Lynam, 1996; Babinski et al, 1999), this was also an indicator that lower levels of conduct problems in girls might be expected at age 4.

It was also of interest to establish the extent to which the less severe profile of concurrent risk factors evident in "at risk" girls at age 3 would be replicated at age 4. As mentioned above, "at risk" girls in the larger sample at time 1 presented with significantly lower levels of experimenter-rated hyperactivity, but they also displayed significantly advanced performance on theory of mind tasks and a trend towards better non-verbal ability than "at risk" boys. It was anticipated that these strengths could protect girls against continued conduct problems in the future and that they would continue to present with a less severe risk factor profile than boys.

4.1.3 "Persisters" and "Desisters

A study of older children with clinical diagnoses of conduct disorder reported a similar pattern of behavioural continuity reported in Richman et al's (1982) study, suggesting that Richman et al's (1982) findings might be applied across a wider age range and greater severity of behaviour problems (Lahey, Loeber, Burke & Rathouz, 2002). In this study 73 clinic-referred 7-12 year old boys were followed up across 7 waves of data collection until they were 13-18 years old. Most of the children continued to engage in a significant number of CD behaviours, and less than 15% recovered and abstained from the behaviours over time. Some children showed increasingly more severe conduct behaviours during the course of the study whilst others showed little change. Significant predictors of desistence from CD were fewer ADHD symptoms and less serious conduct problems at baseline. It also emerged that a baseline verbal IQ score of greater than or equal to 115 predicted a more favourable outcome, and being from a family of high income and high maternal education level, with no history of parental antisocial personality, predicted a reduction of CD behaviour over time. There is a need for a greater understanding of the factors predicting persistence and desistence of conduct problems (Hill, 2003), in order to more accurately identify "at risk" children in the pre-school years, and hence these are important findings.

Consistent with Richman et al's (1982) findings therefore, Lahey et al (2002) found that being identified as having significant behaviour problems at a young age tends to predict continued problems later in development. Findings indicated that having a number of risk factors alongside the behavioural symptoms tended to differentiate "persisters" from "desisters". Thus, as well as predicting that children in the current study with early conduct problems are likely to continue to differ from control children in terms of behaviour at age 4, it may also be the case that children whose behaviour does improve (i.e. "desisters") may differ from those whose behaviour does not improve ("persisters") in terms of risk factors. Severity of conduct problems and hyperactivity at time 1 as well as verbal ability at time 1 are likely to constitute particularly important risk factors. The risk factors in the present study do not overlap exactly with the factors considered in Lahey et al's (2002) study, and the children are significantly younger. Thus to extend these findings to a younger sample and to identify other potential risk factors for continuity is an important contribution to the literature. Nevertheless, Lahey et al's (2002) study focused exclusively on boys and hence could not address the issue of gender differences in the risk factors predictive of stability of conduct problems.

We have already predicted that conduct problems will show greater continuity in boys than girls, and hence implicit in this prediction is the hypothesis that a greater number of male than female "persisters" will emerge.

4.1.4 Summary of chapter 4 aims and hypotheses:

- "At risk" children will continue to have significantly higher levels of conduct problems, poorer verbal ability, poorer social skills and higher levels of hyperactivity at age 4 compared with children in the pre-identified "low risk" group. "At risk" children will also have poorer ToM and IC skills at age 4 compared with the "low risk" children. Within the "at risk" group, the "pervasive" group are hypothesised to present with significantly poorer functioning across all the above risk factors than the "situational" group.
- Girls in the "at risk" group are hypothesised to continue to show a less severe risk factor profile than boys in the "at risk" group. At age 3 girls presented with significantly lower levels of hyperactivity and significantly advanced ToM skills, with a trend towards better non-verbal ability than boys. These differences are expected to be replicated at age 4.
- Girls' conduct problems will not be as stable as boys' conduct problems, and thus there will be a greater proportion of female desisters than male desisters.
- Desisters are expected to have presented with a significantly less severe risk factor profile at age 3 than persisters and to present with a significantly less severe risk factor profile at age 4 than persisters. Age 3 levels of conduct problems and hyperactivity, and verbal competency are proposed to be three important risk factors for differentiating desisters and persisters.

4.2 Method

4.2.1 Follow-up procedure

Approximately 1 year after the first assessment, families were re-contacted by telephone in the first instance and then by letter, to take part in the study again. All questionnaires and measures were the same as those administered at baseline assessment. Once parents had agreed to complete the questionnaires again and given consent for a repeat assessment to be conducted with their children, questionnaires were sent by post for parents to complete and a reminder telephone call was made if necessary to increase the number of questionnaires returned. Parents were first contacted via the contact details they had provided at baseline assessment. If this failed, nurseries were contacted and asked to pass on new contact details for the families as well as details of the new school if applicable. This request was made in collaboration with local community clinical psychology services attached to the nurseries. If nurseries were not aware of the new contact details for the family, local clinical psychology services attempted to access the information via the family's last known GP.

An appointment was made to see the child either at nursery or at school, depending on whether the child had moved to school since the previous assessment. Schools not familiar with the project were contacted by letter explaining the project and then by telephone to arrange an appointment to see the child. All schools consented, and many of the schools local to the area had several children from the cohorts in their new intakes, such that the project did not always need to be explained from scratch each time a child had been tracked to a school at follow-up. During the visit to assess the child, nursery or school staff were given a copy of the same teacher questionnaires as used at baseline assessment to complete and return. Again, follow-up telephone calls were made if questionnaires were not returned in order to maximise the number of questionnaires completed.

Every attempt was made to conduct the follow-up assessments as close to 12 months after the first assessment as possible, however the follow-up period ranged from 8 months (N=5) to 18 months (N=2), with a mean follow-up period of 12.4 months (SD 2.4 months). The follow-up period refers to the date the child was seen for direct testing by the experimenter at follow-up relative to the date the child was seen at pre-test. Parent and teacher questionnaire completion did not occur at exactly the same time as the direct child assessment either at pre-test or follow-up, and hence this is only an approximation of the overall period of time between each piece of longitudinal data collection.

Sometimes parents returned questionnaires before or shortly after the child assessment, whereas sometimes there was a delay in the return of the questionnaires. The same applied to receiving the teacher questionnaires, which were sometimes completed during the experimenter's visit to the school at the time of the child assessment, and sometimes arrived in the post some time later.

4.2.2 Participants: percentage and description of sample followed up

Of the 218 children in the original sample, at least one piece of follow-up data was obtained on 156 children. Direct child data were obtained for 148 children (68%), parent questionnaires were returned from 108 parents (50%), and teacher questionnaires were returned from 107 teachers (49%). 73 children (33%) had follow-up data from all 3 sources (direct child testing, parent questionnaires and teacher questionnaires). Of the 156 children with time 2 data, 96 were still at nursery and 60 had moved to school.

The main reason for not obtaining follow-up data from direct testing on the children was being unable to trace families or families having moved out of the area or even abroad. In other words, most families, if contactable, agreed to the child assessments taking place. This was thereby the easiest aspect of follow-up data to obtain (hence the greater number of direct assessments with the children compared with parent and teacher derived data), since it did not rely on questionnaire completion by parents or teachers. Only 5 families decided not to take part in the project again when they were contacted, 2 of whom were too busy to complete the questionnaires, and 3 of whom stated that their children were receiving a lot of input from other agencies or services and had therefore already undertaken numerous assessments during school time. Thus completing further assessments for the current project would have been a further disruption to their children's schooling. Of course, it is likely that these children may have been likely to present with some of the difficulties of interest in the present study, and to this end it is unfortunate that they were also the families least likely to participate at follow-up.

Cases in which follow-up data were not obtained from parents was due in the most part to parents not returning the questionnaires despite "verbally consenting" to do so and being sent copies of the questionnaires on at least 2 occasions with at least 2 follow-up phone-calls. However, in 2 cases parents consented to their child being seen but not to completing the questionnaires due to time constraints, and in 4 cases parents consented over the telephone to their child being seen but had limited English to complete the questionnaires without an interpreter. Where possible parents with English as a second language were seen with an interpreter (N=3) but in the aforementioned 4 cases this was not possible due to lack of access to an interpreter for the particular language (N=1), and parents not attending scheduled appointments (N=3). With regard to teachers, none outwardly refused to complete the questionnaires although many failed to return them even after verbally agreeing to do so and several subsequent reminders.

The 156 children on whom at least one piece of follow-up data was obtained consisted of 73 boys and 83 girls, thus 70% of the boys and 73% of the girls were followed up. Children's age at follow up ranged from 47 months to 71 months, with a mean age at follow-up of 54 months (standard deviation 4 months). Children followed up versus those not followed up did not differ significantly in terms of ethnicity, social status, proportion of families with English as a second language or any other demographic variable (see appendix H) except that children followed up had parents with a significantly higher level of education (X^2 (4, 203) = 17.10, $p<0.01$). Children followed up did not differ from those not followed up in terms of behaviour at time 1 (including social skills, hyperactivity, emotional problems and conduct problems) or non-verbal IQ, verbal ability, theory of mind or inhibitory control ability at time 1 (see appendix H).

4.2.3 Participants: percentage and description of "at risk" and "low risk" sub-sample followed up

In the original "at risk" group described in chapter 2, there were 72 children, consisting of 30 boys and 42 girls. Of those 72 children, at least one piece of follow-up data was collected on 51 children (71%). More specifically, follow-up child data were collected on 47 children (65%), follow-up parent data were obtained from 30 families (42%) and 36 follow-up teacher questionnaires were returned (50%). This group of followed-up "at risk" children consisted of 21 boys and 30 girls. Thus, some follow-up data for the "at risk" group was obtained for 70% of the boys and 71% of the girls.

With regard to the group of children with pervasive conduct problems identified by both parents and teachers at baseline assessment, originally there were 12 children in this group, made up of 3 boys and 9 girls. Child follow-up data were collected on 9 children (75%; 1 boy and 8 girls), with parent data obtained for 6 of the children (50%) and teacher data for 5 of the children (42%).

The "low risk" group at baseline consisted of children with low levels of conduct problems at age 3 according to both parents and teachers. This group was comprised of 48 children, of which 23 were boys and 25 were girls. At 1-year follow-up, at least 1 item of follow-up data was obtained from 32 children (67%). In terms of individual items of data, direct child data were collected for 30 of these children (63%), parent data for 25 of the children (52%) and teacher data for 18 of the children (38%). Of the children followed up, 15 were boys and 17 were girls, and hence at least 1 item of follow-up data for the "low risk" group was obtained for 65% of the boys and 68% of the girls.

Several tests of the representativeness of the followed-up "at risk" group were conducted, in order to determine the extent to which the group of "at risk" children who were followed up resembled the group of "at risk" children originally tested at time 1. When children in the "at risk" group for whom child follow-up data were available were compared with children in the "at risk" group who were not followed up on characteristics at baseline assessment, a number of significant differences were noted. "At risk" children who were followed up differed from children who were not followed up in that those for whom follow-up data were obtained were significantly more likely to be from families in which parents were employed (N=20, 40% versus N=2, 11%, X^2 (1, 68) = 5.05, $p<0.05$) and to have English as a first language (N=36, 71% versus N=8, 38%, X^2 (1, 72) = 6.61, $p<0.05$). No significant differences emerged with regard to baseline measures of child behavioural or cognitive functioning in the followed-up versus not followed-up "at risk" children (see appendix I). Furthermore, the proportion of children from different ethnic groups or from families with different levels of maternal education did not differ in those followed up versus those not followed up (appendix I). Children in the "low risk" group who were followed up did not differ significantly from those not followed up on any of the measures at baseline (appendix J), except that children followed up presented with significantly higher levels of teacher-rated conduct problems than children in the "low risk" group who were not followed up (F (1, 46) = 4.29, $p<0.05$). Nevertheless, since the mean scores for the teacher-rated conduct problems scale were extremely low for both groups, at 0 and 0.22 for the followed-up and not followed-up group respectively, this result was not of concern. Scores on this scale range from 0 to 10.

4.2.4 Measures

All of the follow-up measures were the same as those taken at baseline assessment, described in detail in chapter 2.

4.2.5 Analyses

A series of Oneway ANOVAs were conducted comparing the mean scores of children in the "at risk" and "low risk" groups on cognitive and behavioural risk factors at time 2, to determine the extent to which being "at risk" for conduct problems at age 3 was predictive of overall impaired functioning at age 4 relative to children deemed "low risk" for conduct problems at age 3. Levels of conduct problems at time 2 in the two groups were also compared.

Since the number of children with "pervasive" risk for conduct problems at age 3 who were followed up was especially small (N=9 overall, but as small as 5 for some data points), the data for these children at age 4 are presented as individual case studies, rather than attempting to statistically analyse such a small group.

In addition, oneway ANOVAs were computed to determine whether there were differences in the risk factors and levels of conduct problems at time 2 of boys versus girls within the "at risk" group. This was to ascertain whether risk for conduct problems at age 3 might be differentially predictive of impairment at age 4 depending on gender. Finally, we aimed to identify a group of "persisters" and a group of "desisters" from the original "at risk" group, in terms of the continuity of their conduct problems at age 4. Risk factor profiles of "persisters" versus "desisters" at age 3 and age 4 were compared using oneway ANOVAs, to address the issue of which risk factors might best predict or be associated with enduring conduct problems, at least in the preschool years.

For all analyses, ANCOVAs controlling for NVIQ and verbal ability at time 1 were computed. This was to establish whether cognitive ability at time 1 rather than group status ("at risk" vs. "low risk", male vs. female or "persister" vs. "desister") accounted for any differences in risk factors at time 2. Further ANCOVAs were also computed, controlling for hyperactivity (parent, teacher and experimenter-rated) at time 1. This was to ascertain whether group differences in risk factors at time

2 were due to co-morbid hyperactivity at time 1 rather than group status. All 3 ratings of hyperactivity were entered together in one block as covariates.

As in chapter 2, effect sizes shall be discussed in the following terms: lower than .5 refers to a small or weak effect size, greater than .5 but lower than .8 denotes a moderate effect size, and .8 or higher is considered a large effect size (Cohen, 1988).

4.3 Results

4.3.1 Oneway ANOVAs comparing "at risk" and "low risk" groups on cognitive and behavioural risk factors at time 2 (age 4)

Aims and hypotheses: *Children identified as "at risk" at age 3 will continue to display significantly higher levels of conduct problems at age 4 than the pre-identified "low risk" group. Furthermore, the "at risk" children will continue to present with poorer verbal ability, poorer social skills and higher levels of hyperactivity than the "low risk" children at age 4. In addition, at this later stage in development it is anticipated that the "at risk" group will also present with significantly poorer ToM and IC skills at age 4 compared with the "low risk" group.*

As pointed out in section 4.2.3, not all of the original sample were followed up. Therefore, some of the children in the analyses at age 3 (reported in chapter 2) are not in the follow-up analyses. We therefore did not consider a comparison of our age 4 data with the original age 3 data in the larger sample to be appropriate. Despite the fact that, as reported in section 4.2.3, there were no significant differences overall in terms of the behavioural and cognitive profiles of the followed-up versus the not followed-up groups, we expected that many of the children not followed-up would have been some of the most troubled and concerning cases. For this reason, to be cautious, we carried out the same set of analyses on the time 1 data as in chapter 2, but this time including only the children for whom we had obtained follow-up data. This gave us a new comparison base for the age 4 data, in which we could be sure that any differences between the age 3 and age 4 data were not due to the fact that the two datasets included different children.

A small section at the beginning of each set of analyses will therefore review the findings from the time 1 analyses of this "followed-up" sample, and consider the extent to which the time 1 data from the "followed-up" sample is representative of the original time 1 findings from the larger sample in chapter 2.

One further difference in these time 1 analyses in the "followed up" sample compared to the data presented in chapter 2, is that we have included a comparison of the groups with regard to levels of conduct problems. We know that at time 1 the "at risk" group will have differed significantly from the "low risk" group on at least one of these measures since this was the defining criteria for designation to one of the groups. However, it is of interest to ascertain the extent to which the magnitude of difference in levels of conduct problems between the two groups has changed over the course of a year, in other words are the "at risk" group still showing higher levels of conduct problems?

"Followed-up" versus larger sample at time 1

It is evident from comparison of tables 4.1 and 4.2 with tables 2.3 and 2.4 in chapter 2 that, overall, the followed-up sample showed a similar pattern of differences in risk factors between the "at risk" and "low risk" groups at time 1 that were seen in the larger sample at time 1. Table 4.1 indicates that in the followed-up sample, the "at risk" group presented with significantly poorer verbal ability at time 1. This was comparable to the results reported in the larger sample in chapter 2, with the groups just under a standard deviation apart, although the effect size of 0.58 in the followed-up sample was somewhat smaller than that of 0.72 in the larger sample. This suggests either that some of the children with very poor verbal ability in the "at risk" group, or some of the children with very good verbal ability in the "low risk" group, were not followed up. The difference between the two groups with regard to verbal ability remained significant when controlling for the shared variance with non-verbal ability ($F (1, 79) = 4.79$, $p<0.05$), also consistent with findings in the larger sample at time 1. However, whereas in the larger sample the difference also remained significant when controlling for co-morbid hyperactivity, in the followed-up sample the difference between the "at risk" and "low risk" groups in terms of verbal ability no longer reached significance ($F (1, 68) = 1.85$, n.s.). Nevertheless, the pattern of findings was largely consistent with the originally reported findings in chapter 2.

Also consistent with findings reported in chapter 2 with regard to the larger sample, no significant differences emerged in the followed-up sample between the two groups with regard to non-verbal ability, theory of mind or inhibitory control competency at time 1 (see table 4.1). Comparable, weak effect sizes for both sets of analyses (Non-verbal ability: 0.32 followed-up sample, 0.33 larger sample; ToM: 0.06 followed-up sample, 0.16 larger sample; IC: 0.16 followed-up sample, 0.27 larger sample) indicate that the followed-up sample is generally representative of the original sample with regard to the relative performance of the "at risk" and "low risk" groups on non-verbal ability, ToM and IC tasks at time 1.

Table 4.1: "At risk" vs. "Low risk" (those with time 2 data) on cognitive risk factors at time 1

	"Low risk" group (N=32)	"At risk" group (N=51)				
Risk factor	Mean (SD)	Mean (SD)	Effect size	Significant difference?	*Covaried for T1 NVIQ and verbal ability*	*Covaried for T1 hyp*
Non-verbal IQ◊	96.66 (18.52) N=32	90.69 (18.45) N=48	0.32	n.s.	*n.s.*	*n.s.*
Verbal ability ◊◊	98.50 (19.20) N=32	86.94 (19.23) N=48	0.58	**	*	*n.s.*
ToM	1.88 (1.34) N=32	1.80 (1.19) N=46	0.06	n.s.	*n.s.*	*n.s.*
IC	.66 (.70) N=32	.54 (.78) N=46	0.16	n.s.	*n.s.*	*n.s.*

*p<0.05; **p<0.01; ***p<0.001
◊Only covaried for verbal ability; ◊◊Only covaried for non-verbal IQ

Parent and teacher-rated social skills were also significantly poorer in the "at risk" group than the "low risk" group, with teacher-rated social skills showing the largest difference (table 4.2). This was consistent with findings in the larger sample, whereby in both the larger sample and the followed-up sample the "at risk" group scored around a standard deviation below that of the "low risk" group. Comparable effect sizes of 0.69 in the larger sample and 0.78 in the followed-up sample with regard to parent-rated social skills, and 0.83 in the larger sample and 0.89 in the followed-up sample with regard to teacher-rated social skills, confirm that the findings were sufficiently similar in the followed-up sample. Differences between the groups with regard to social skills, as reported in the larger sample, remained significant in the followed-up group when controlling for non-verbal and verbal ability (parent-rated: $F(1, 79) = 8.43$, $p<0.01$; teacher-rated: $F(1, 57) = 6.95$, $p<0.05$) and hyperactivity (parent-rated: $F(1, 69) = 8.40$, $p<0.01$; teacher-rated: $F(1, 57) = 7.51$, $p<0.01$).

As found in the larger sample, the "at risk" group also displayed significantly higher levels of parent, teacher and experimenter-rated hyperactivity than the "low risk" group in the followed-up sample at time 1. Effect sizes denoting the magnitude of group differences were slightly higher in the larger sample with regard to parent and teacher-rated hyperactivity, although effect sizes in the followed-up sample were still moderate in size (parent-rated: 0.73 larger sample, 0.60 followed-up sample; teacher-rated: 0.76 larger sample, 0.69 followed-up sample). Effect sizes for experimenter-rated hyperactivity were, if anything, larger in the followed-up sample, though weak in magnitude for both samples (experimenter-rated: 0.39 larger sample, 0.46 followed-up sample). Consistent with findings in the larger sample, group differences remained significant when controlling for non-verbal and verbal ability with regard to teacher-rated hyperactivity ($F\ (1, 68) = 5.21$, $p<0.05$), approached significance with regard to parent-rated hyperactivity ($F\ (1, 79) = 3.60$, $p=0.062$, n.s.) and no longer reached significance with regard to experimenter-rated hyperactivity ($F\ (1, 79) = 1.51$, n.s.).

In chapter 2 the differences between the two groups with regard to levels of conduct problems were not considered, since the groups were selected on the basis of their scores on the conduct problems scales and would therefore by default differ significantly. However, for the purposes of comparison with the time 2 data, it is worth noting that in this followed-up sample at time 1, the "at risk" group displayed significantly higher levels of both parent and teacher-rated conduct problems than the "low risk" group (parent-rated: $F\ (1, 82) = 119.25$, $p<0.001$; teacher-rated: $F\ (1, 71) = 48.34$, $p<0.001$), with very large effect sizes denoting large magnitudes of difference (parent-rated: 1.58, teacher-rated: 1.28).

More specifically, the mean score of 1 for parent-rated conduct problems in the "low risk" group equates to a score above the population 51st percentile for boys and 60th percentile for girls. In the "at risk" group on the other hand, the mean score of 4.65 translates to a score above the population 94th percentile for boys and 96th percentile for girls, with a clearly higher level of pathology in the "at risk" group. The mean scores for teacher-rated conduct problems showed a similar pattern. Thus, the mean score of 0.22 in the "low risk" group corresponds to a score above the population 55th percentile for boys and 74th percentile for girls, whilst 2.90 in the "at risk" group places the group above the population 89th percentile for boys and 95th percentile for girls.

In addition, the group differences in parent and teacher-rated conduct problems remained significant when controlling for both verbal and non-verbal ability (parent-rated: $F\ (1, 79) = 96.38$, $p<0.001$;

teacher-rated: F (1, 68) = 37.42, p<0.001) and co-morbid hyperactivity (parent-rated: F (1, 69) = 67.88, p<0.001; teacher-rated: F (1, 69) = 29.88, p<0.001).

Table 4.2: "At risk" vs. "Low risk" (those with time 2 data) on behavioural measures at time 1

	"Low risk" group (N=32)	"At risk" group (N=51)				
Risk factor	Mean (SD)	Mean (SD)	Effect size	Significant difference?	*Covaried for T1 NVIQ and verbal ability*	*Covaried for T1 hyp*
Parent-rated conduct problems	1.00 (.76) N=32	4.65 (1.79) N=51	1.58	***	***	***
Teacher-rated conduct problems	.22 (.42) N=32	2.90 (2.15) N=40	1.28	***	***	***
Parent-rated social skills	107.06 (13.56) N=32	94.22 (16.45) N=51	0.78	***	**	**
Teacher-rated social skills	100.68 (14.00) N=28	85.47 (16.51) N=32	0.89	***	*	**
Parent-rated hyp	2.41 (1.62) N=32	3.76 (2.45) N=51	0.60	**	*p=0.062*	*N/A*
Teacher-rated hyp	2.19 (2.42) N=32	4.07 (2.67) N=40	0.69	**	*	*N/A*
Exptr-rated hyp	9.75 (4.44) N=32	12.47 (6.56) N=49	0.46	*	*n.s.*	*N/A*

*p<0.05; **p<0.01; ***p<0.001

Main analyses

Having established that the time 1 analyses in the followed-up sample largely reflect the findings reported on the basis of the larger sample in chapter 2, the focus can now move to establishing how different the "at risk" and "low risk" groups looked at time 2 (see tables 4.3 and 4.4).

Table 4.3 demonstrates that the " at risk" group presented with significantly poorer verbal ability at age 4 than the "low risk" group, as hypothesised (F (1, 75) = 4.98, $p<0.05$). The effect size of 0.51 denotes a difference that is moderately large in magnitude, although worthy of note is the fact that, although over half a standard deviation below the "low risk" group, the "at risk" group were still functioning well within the population average range with regard to verbal ability (mean score 95.26 in the "at risk" group, compared with 103.79 in the "low risk" group). Furthermore, when time 1 non-verbal ability was covaried for, the groups were no longer significantly different. The covariate effect for time 1 non-verbal ability was significant (F (1, 72) = 22.47, $p<0.001$). This suggests that differences in verbal ability at time 2 between the two groups may have been due to the pre-existing (time 1) poorer non-verbal ability of the "at risk" group compared with the "low risk" group, rather than due to their higher levels of conduct problems. The group differences also failed to reach significance when co-morbid hyperactivity at time 1 was covaried for. No individual covariate effects for any of the hyperactivity ratings were significant, but the results indicate that, overall, higher levels of hyperactivity in the "at risk" group relative to the "low risk" group at time 1, to a greater degree than their higher levels of conduct problems, may have been responsible for the poorer verbal ability in the "at risk" group at time 2.

Non-verbal IQ at time 2 was not hypothesised to differentiate the "at risk" group from the "low risk" group at time 2, by virtue of the lack of difference between the two groups apparent at time 1. However, the groups did differ significantly at time 2 (see table 4.3), with higher non-verbal ability in the "at risk" group compared with the "low risk" group (F (1, 76) = 5.05, $p<0.05$). The magnitude of difference was comparable to the difference in verbal ability (effect size 0.51), indicating that the relative deficit in intellectual functioning in the "at risk" relative to the "low risk" group at time 2 was not specific to verbal ability. Also consistent with time 2 findings with regard to verbal ability, the functioning of the "at risk" group in terms of non-verbal ability was well within the population average range (mean score 97.98), yet nevertheless this was still two-thirds of a standard deviation below the mean score of the "low risk" group (108.10).

A point worth noting is that whilst both verbal and non-verbal ability fell within the population average range in the "at risk" group at time 2, the standard deviations for both aspects of cognition were larger in the "at risk" than the "low risk" group (see table 4.3), indicating greater variability in the "at risk" group. This suggests that although they scored in the average range *as a group*, there are likely to be a greater number of children with very low scores in the "at risk" than the "low risk" group. This was confirmed when looking at the number of children with verbal and non-verbal IQ scores equal to or lower than 80. 1 child in the "low risk" group (3%) compared with 10 children in the "at risk" group (21%) scored 80 or lower on verbal ability, whilst 3 children in the "low risk" group (10%) compared with 12 children in the "at risk" group (26%) had scores of 80 or lower for non-verbal ability.

The group difference in non-verbal ability could not be considered to be independent of the differences in verbal ability between the two groups at time 1 or independent of the differences in levels of hyperactivity at time 1 between the two groups. In other words, the groups did not only differ with regard to levels of conduct problems, in fact the "at risk" group were also displaying poorer verbal skills and elevated levels of hyperactivity. Indeed, the group differences with regard to these other areas of functioning, rather than conduct problems, could have been more important for the observed differences in non-verbal ability at time 2. This was shown when covarying for time 1 verbal ability, after which the groups were no longer significantly different in terms of time 2 non-verbal ability ($F(1, 73) = 1.41$, n.s.). The same pattern was observed when time 1 hyperactivity ($F(1, 63) = 1.23$, n.s.) was covaried for. Significant individual covariate effects emerged for time 1 verbal ability ($F(1, 73) = 13.19$, $p<0.001$) and time 1 experimenter-rated hyperactivity ($F(1, 63) = 4.16$, $p<0.05$).

It was hypothesised that at time 2 the "at risk" group would demonstrate significantly poorer ToM and IC skills than the "low risk" group. Whilst the pattern of results was in the hypothesised direction, the differences were not significant (ToM: $F(1, 76) = 0.68$, n.s; IC: $F(1, 76) = 2.14$, n.s.) and effect sizes were small in magnitude (ToM: 0.20, IC: 0.34).

Table 4.3: "At risk" versus "Low risk" on cognitive risk factors at time 2

	"Low risk" group (N=32)	"At risk" group (N=51)				
Risk factor	Mean (SD)	Mean (SD)	Effect size	Significant difference?	*Covaried for T1 NVIQ and verbal ability*	*Covaried for T1 hyp*
Non-verbal IQ◊	108.10 (17.95) N=30	97.98 (20.06) N=47	0.51	*	*n.s.*	*n.s.*
Verbal ability ◊◊	103.79 (14.13) N=29	95.26 (17.35) N=47	0.51	*	*n.s.*	*n.s.*
ToM	2.77 (1.22) N=30	2.53 (1.21) N=47	0.20	n.s.	*n.s.*	*n.s.*
IC	1.37 (.72) N=30	1.11 (.79) N=47	0.34	n.s.	*n.s.*	*n.s.*

*p<0.05; **p<0.01; ***p<0.001
◊Only covaried for T1 verbal ability; ◊◊Only covaried for T1 non-verbal IQ

Table 4.4 details the group differences with regard to the behavioural risk factors as well as levels of conduct problems. At time 2, as predicted, both parent and teacher-rated conduct problems remained significantly higher in the "at risk" group in comparison with the "low risk" group (Parent-rated conduct problems: $F(1, 54) = 26.98$, $p<0.001$; Teacher-rated conduct problems: $F(1, 53) = 8.38$, $p<0.01$). The effect sizes of 1.16 for parent-rated conduct problems and 0.78 for teacher-rated conduct problems indicate that the group differences were moderate to large. In fact, the differences translate to the following in terms of levels of conduct problems: in the "low risk" group the mean score of 1.32 for parent-rated conduct problems is equivalent to scoring above the population 52nd percentile for boys, and above the population 61st percentile for girls, whereas the mean score of 3.70 in the "at risk" group reflects a score above the population 91st percentile for boys and above the population 95th percentile for girls. For teacher-rated conduct problems the mean score of 0.56 in the "low risk" group equates to a score above the population 63rd percentile for boys and 79th percentile for girls, whilst the mean score of 2.19 in the "at risk" group translates to a score above the population 82nd percentile for boys and 92nd percentile for girls.

These differences remained significant when covarying for time 1 verbal and non-verbal ability (parent-rated conduct problems: $F(1, 52) = 23.21$, $p<0.001$; teacher-rated conduct problems: $F(1, 51) = 5.64$, $p<0.05$), indicating that poorer intellectual functioning in the "at risk" group relative to the "low risk" group at time 1 did not better account for the group differences than the higher levels of conduct problems in the "at risk" group at time 1. Parent-rated conduct problems at time 2 were also significantly higher in the "at risk" than the "low risk" group when controlling for time 1 hyperactivity ($F(1, 47) = 17.18$, $p<0.001$). This result suggests that higher levels of hyperactivity at time 1 in the "at risk" group relative to the "low risk" group did not account for their higher levels of conduct problems at time 2 according to parent ratings. However, teacher ratings of conduct problems at time 2 were more strongly associated with hyperactivity at time 1 than with conduct problems at time 1. Thus, controlling for time 1 hyperactivity ($F(1, 44) = 2.23$, n.s.), the groups no longer differed significantly with regard to levels of teacher-rated conduct problems at time 2. The only individual covariate effect that reached significance was time 1 teacher-rated hyperactivity ($F(1, 44) = 4.60$, $p<0.05$).

Consistent with our hypothesis, at time 2 the "at risk" group presented with significantly lower scores with regard to parent ($F(1, 54) = 9.86$, $p<0.01$) and teacher-rated social skills ($F(1, 51) = 7.21$, $p<0.01$), see table 4.4. Effect sizes of 0.79 for parent-rated social skills and 0.75 for teacher-rated social skills are moderate to large, indicating substantial group differences. However, although the "at risk" group scored two-thirds of a standard deviation below the "low risk" group on parent-rated social skills (mean score 98.97 compared with 109.20) and almost a standard deviation below the "low risk" group on teacher-rated social skills (98.51 compared with 111.35), the "at risk" group were functioning in the mid-average range according to population norms (mean of 100 and SD of 15). Thus, although they were significantly poorer than the "low risk" group in terms of social skills, they were not performing below the level expected of their age group. The group difference remained significant with regard to parent-rated social skills ($F(1, 52) = 10.34$, $p<0.01$) and approached significance with regard to teacher-rated social skills ($F(1, 49) = 3.61$, $p=0.064$, n.s.), when non-verbal and verbal ability at time 1 were controlled for.

Teacher-rated social skills were no longer significantly poorer in the "at risk" relative to the "low risk" group when time 1 hyperactivity ($F(1, 42) = 0.68$, n.s.) was covaried for, although none of the individual covariate effects were significant. It may be that higher levels of hyperactivity overall at time 1 in the "at risk" group compared with the "low risk" group, rather than higher levels of conduct problems, were associated with the relatively poorer teacher-rated social skills in the "at risk" group at time 2. Perhaps being hyperactive at school or nursery at age 3, rather than having conduct problems, is associated with poor social skills at school or nursery a year later. The pattern with regard to parent-rated social skills on the other hand, remained significant when covarying for time 1 hyperactivity ($F(1, 47) = 6.65$, $p<0.05$), suggesting that conduct problems at age 3 predict poor parent-rated social skills at age 4, independently of levels of co-morbid hyperactivity at age 3.

Finally, as hypothesised, the "at risk" group displayed significantly elevated levels of hyperactivity at age 4 compared with the low risk group (see table 4.4) according to parents ($F(1, 54) = 6.30$, $p<0.05$) and teachers ($F(1, 53) = 9.45$, $p<0.01$). Furthermore, a non-significant trend also emerged towards higher levels of experimenter-rated hyperactivity in the "at risk" group relative to the "low risk" group ($F(1, 76) = 3.35$, $p=0.071$, n.s.). Effect sizes of 0.65 and 0.83 with regard to parent and teacher-rated hyperactivity respectively, are moderate to large, whereas the effect size of 0.42 referring to the group differences in experimenter-rated hyperactivity is weak. To put the parent and teacher ratings of hyperactivity in context, the mean score of 2.20 for parent-rated hyperactivity in the "low risk" group corresponds to a score above the population 32nd percentile for boys and above the population 47th percentile for girls, compared to the mean score of 3.73 in the "at risk" group, equivalent to a score above the population 58th percentile for boys and 72nd percentile for girls. The mean score for teacher-rated hyperactivity of 1.11 in the "low risk" group relates to a score above the population 29th percentile for boys and 51st percentile for girls, in contrast to the mean score of 3.56 in the "at risk" group which corresponds to a score above the population 58th percentile for boys and 80th percentile for girls. Group differences for parent and teacher-rated hyperactivity remained significant when covarying for time 1 non-verbal and verbal ability (parent-rated: $F(1, 52) = 5.76$, $p<0.05$; teacher-rated: $F(1, 51) = 5.42$, $p<0.05$), although the difference with regard to experimenter-rated hyperactivity no longer approached significance ($F(1, 73) = 1.08$, n.s.). Thus, experimenters' ratings of children's hyperactivity at age 4 may have been more strongly associated with their intellectual functioning a year previously at age 3, than their levels of conduct problems at age 3.

Table 4.4: "At risk" versus "Low risk" on behavioural risk factors at time 2

	"Low risk" group (N=32)	"At risk" group (N=51)				
Risk factor	Mean (SD)	Mean (SD)	Effect size	Significant difference?	*Covaried for T1 NVIQ and verbal ability*	*Covaried for T1 hyp*
Parent-rated conduct problems	1.32 (1.35) N=25	3.70 (1.93) N=30	1.16	***	***	***
Teacher-rated conduct problems	.56 (.86) N=18	2.19 (2.32) N=36	0.78	**	*	*n.s.*
Parent-rated social skills	109.20 (13.07) N=25	98.97 (11.11) N=30	0.79	**	**	*
Teacher-rated social skills	111.35 (14.67) N=17	98.51 (16.84) N=35	0.75	**	*p=0.064*	*n.s.*
Parent-rated hyp	2.20 (1.85) N=25	3.73 (2.55) N=30	0.65	*	*	*N/A*
Teacher-rated hyp	1.11 (1.37) N=18	3.56 (3.22) N=36	0.83	**	*	*N/A*
Exptr-rated hyp	8.93 (3.21) N=30	10.70 (4.63) N=47	0.42	p=0.071	*n.s.*	*N/A*

*p<0.05; **p<0.01; ***p<0.001

Summary of results: *As hypothesised, the "at risk" group continued to display significantly higher levels of conduct problems than the "low risk" group at age 4. Also consistent with hypotheses was the finding that the "at risk" group presented with significantly poorer verbal ability compared with the "low risk" group at age 4, as well as significantly poorer social skills according to both parents and* *teachers, and significantly elevated levels of parent and teacher-rated hyperactivity. They also presented with significantly poorer non-verbal ability than the "low risk" group. No significant group differences with regard to ToM or IC skills emerged, contrary to hypotheses. Most of the group differences were no longer significant after controlling for hyperactivity at time 1, indicating that at age 3, hyperactivity rather than conduct problems differentiated the two groups with regard to cognitive and social risk factors.*

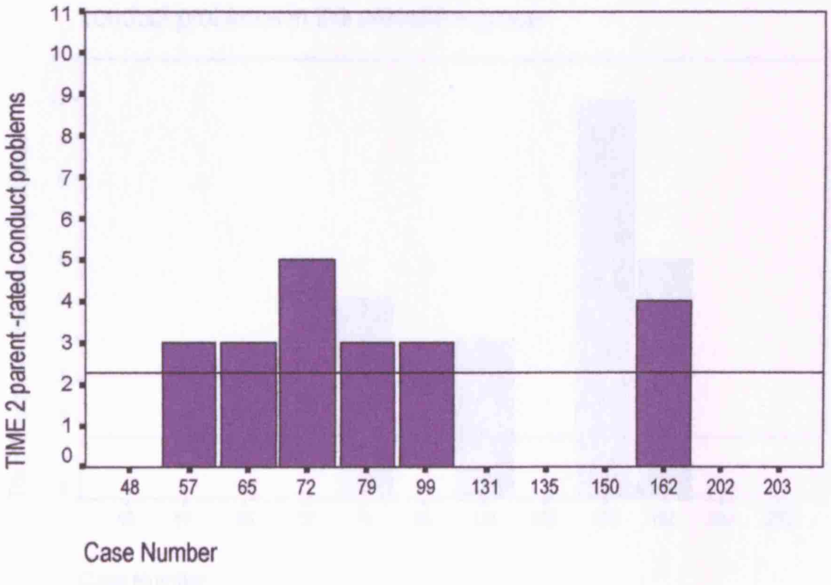
4.3.2 The "pervasive" group at age 4

> ***Aims and hypotheses:*** *Children in the "pervasive" group are expected to show significantly poorer verbal ability and social skills, as well as elevated levels of hyperactivity, than the "situational" group at time 2.*

Unfortunately, only 9 children (8 girls and 1 boy) in the pervasive group were followed up, and even within this small group there was substantial missing data, such that for some risk factors the size of the group was as small as N=4. The group was therefore considered too small to conduct statistical analyses comparing the children's risk factor profiles with children in the "situational" group. However, since we were still interested in the outcome for this group of children, individual case studies relating to each child in the pervasive group, for each risk factor (and for conduct problems) at time 2, are presented as a series of graphs. Each child is shown on a case-by-case basis, with a blank space denoting missing data, thus making it clear when and for whom missing data points arose. On each chart a reference line pertaining to the mean score for the sample as a whole at time 2 is shown, indicating for each risk factor and for each individual child within the "pervasive" group, how far from the sample mean they were functioning at time 2.

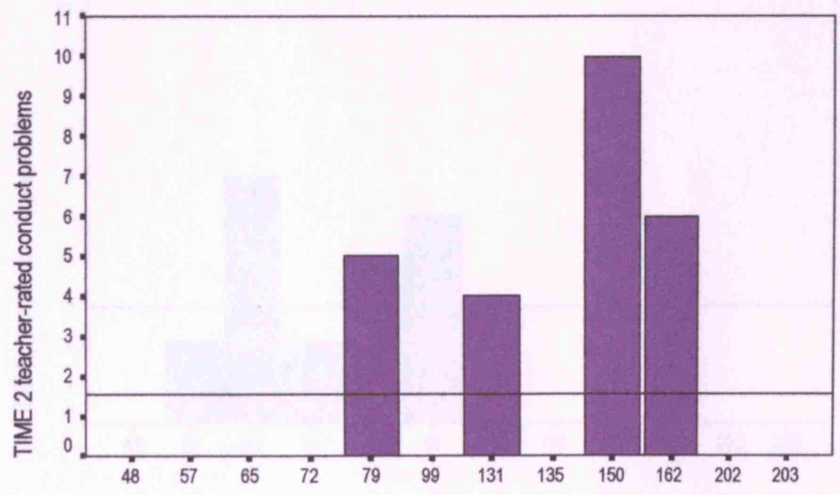
Figure 4.1 details the scores of the children on the parent-rated conduct problems scale of the SDQ at time 2. All 6 children for whom data were available scored above the sample mean of 2.29 (above the population 72nd percentile for boys and 79th percentile for girls), indicating that the group were still displaying higher levels of conduct problems than the sample as a whole, despite the fact that the sample mean was already around the population 70th percentile. Two of the children scored particularly highly, one (a girl) with a score of 5 (equivalent to above the population 98th percentile), and one (a boy) with a score of 4 (corresponding to a score above the population 92nd percentile).

Figure 4.1: Time 2 parent-rated conduct problems in the pervasive group



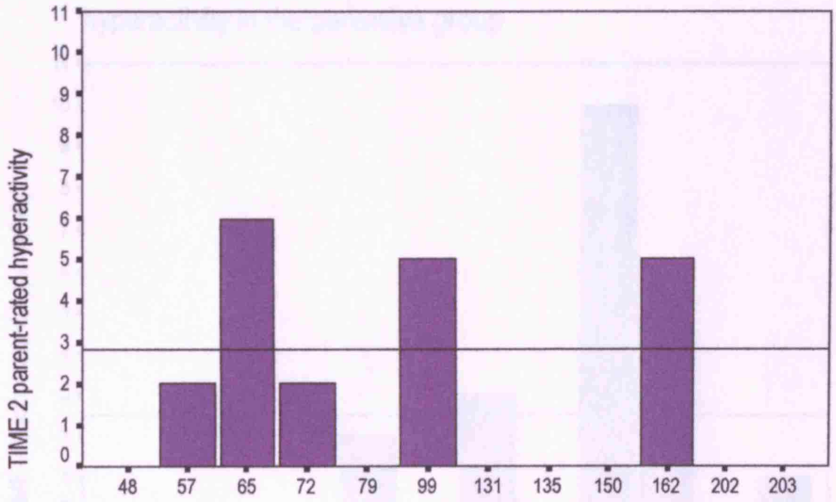
With regard to teacher-rated conduct problems (figure 4.2), of the 4 children for whom data were available (3 girls and 1 boy), all scored at least 2 points higher than the sample mean of 1.54 (which was in itself high, above 75% of the population for boys, and 87% of the population for girls). Scores ranged from 4 (a girl, above 97.7% of the population) through to 10 (a girl, above 100% of the population). These figures are consistent with the notion that the pervasive group were still functioning poorly with regard to levels of conduct problems, although the extent to which this is statistically significant cannot be determined with a group so small.

Figure 4.2: Time 2 teacher-rated conduct problems in the pervasive group



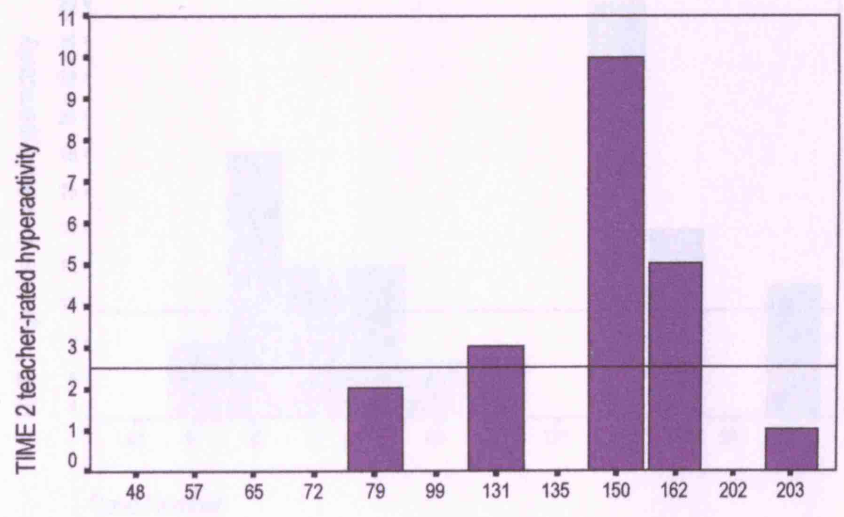
Follow-up data referring to parent-rated hyperactivity at age 4 were available for 5 of the children (figure 4.3). 3 of the children scored above the sample mean of 2.83 (which equates to a score above 45% of the population for boys and 60% of the population for girls). 2 children (1 girl and 1 boy) scored 5 (above 70% of the population for the boy and 82% of the population for the girl), and one child (a girl) scored 6 (above 89% of the population). The other 2 girls scored 2, above only 46.5% of the population, and below the sample mean.

Figure 4.3: Time 2 parent-rated hyperactivity in the pervasive group



Data were also available for 5 children (though not the same 5 children) with regard to teacher-rated hyperactivity (figure 4.4). 3 children (2 girls and 1 boy) scored above the sample mean of 2.49 (above the population 47^{th} percentile for boys and 70^{th} percentile for girls), with scores ranging from 3 (above the population 76^{th} percentile) through to 10 (above the population 100^{th} percentile). The other 2 girls scored 1 and 2, corresponding to scores above the population 50^{th} and 64^{th} percentile respectively, and below the mean level for the whole sample. Hyperactivity scores at time 2 according to parent and teacher ratings therefore showed mixed results in the pervasive children, with around half falling below the sample mean and the other half displaying extremely high levels of hyperactivity, up to a level above 100% of the population.

Figure 4.4: Time 2 teacher-rated hyperactivity in the pervasive group



Case Number

Figure 4.5 displays the scores for experimenter-rated hyperactivity. Here, data regarding all 9 children were available. 6 of the children scored above the sample mean level of 9.65, with 2 particularly extreme scores of 18 and 26 (both girls). Again, results were mixed, this time suggesting that around two-thirds of the group were showing high levels of hyperactivity during the testing session than the rest of the sample, with one-third displaying low levels of hyperactivity.

Figure 4.5: Time 2 experimenter-rated hyperactivity in the pervasive group

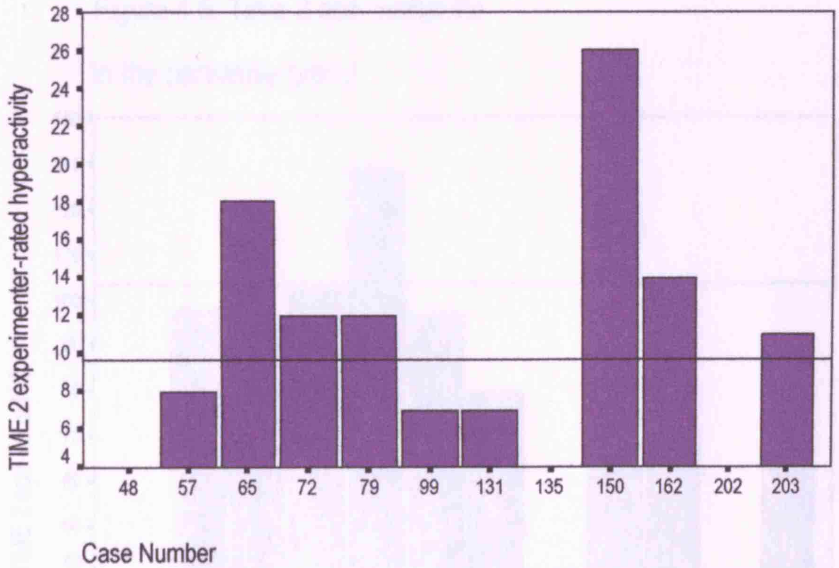
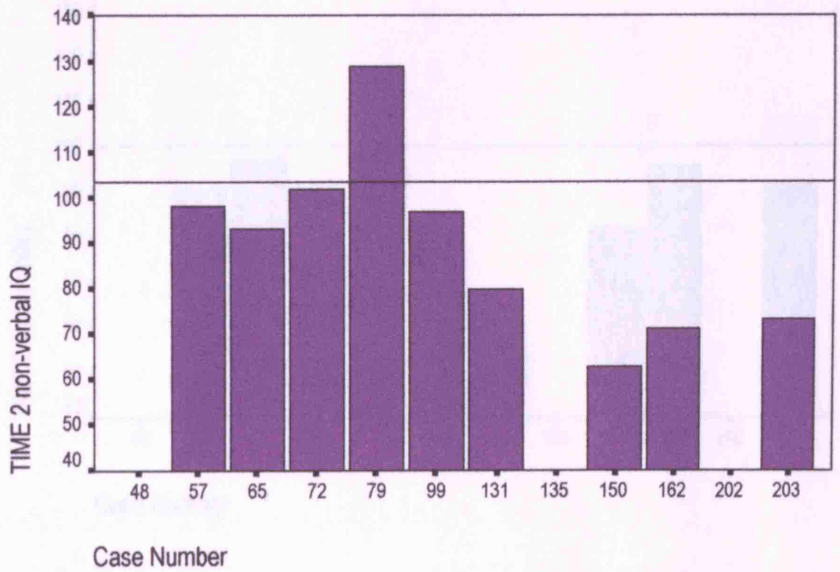


Figure 4.6 pertains to the functioning of the group with regard to non-verbal ability. Again, data for all 9 cases were obtained. The mean score for the sample was 103.6, in the middle of the population average range (mean 100, standard deviation 15). 8 of the 9 children scored below this sample mean, although only 4 fell below the population average range. These 4 cases (3 girls, 1 boy) scored extremely poorly on this measure, ranging from 80 (below average range) to as low as 63 (learning disability level). The one case for whom the non-verbal IQ score was above the sample mean (a girl), had a score of 129, which is above the population 97th percentile. Clearly the group presented with mixed non-verbal ability at age 4, with just under half performing in the borderline/learning disability range and therefore of particular concern, one individual functioning well above average, and the rest in the mid- to low-average range.

Figure 4.6: Time 2 non-verbal IQ

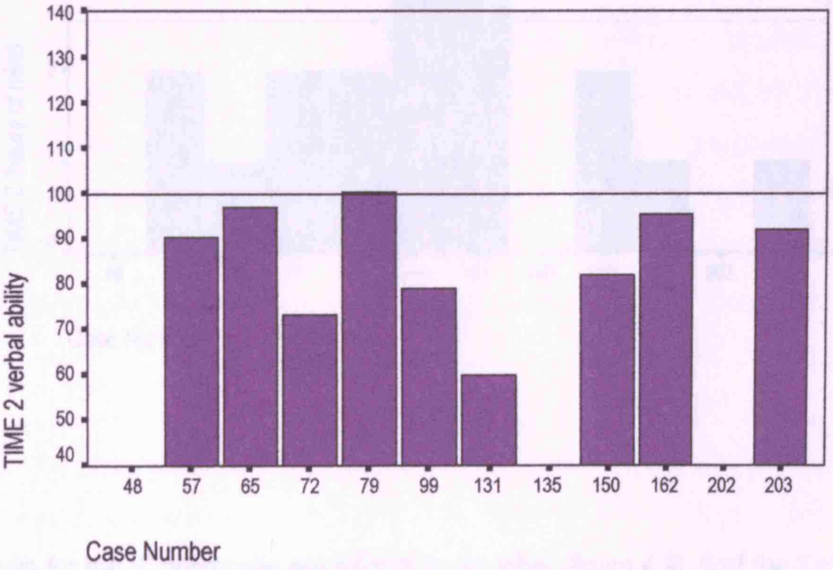
in the pervasive group



A similar mixed pattern emerged with regard to verbal ability (figure 4.7). The sample mean was 99.6, and 8 of the 9 children scored below this level. The same girl scored above the sample mean, although this time her score was within the population average range (100). Again, 4 children (all girls) scored below the population average range, although these 4 children were not all the same children who performed below average on the non-verbal measure. Their scores ranged from 82 (below average range) to 60 (learning disability level).

Figure 4.7: Time 2 verbal ability

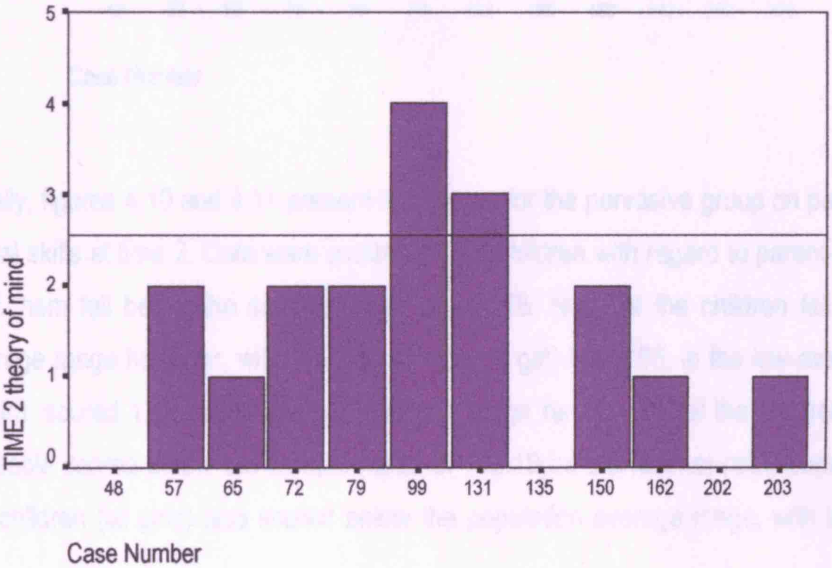
in the pervasive group



The theory of mind measure was scored on a scale of 0-4, referring to the number of ToM items the child passed in the test battery. The mean score for the sample as a whole was 2.56. As figure 4.8 shows, all but 2 of the pervasive group scored below this level, with 3 children (1 boy and 2 girls) passing 1 task, and 4 children passing 2 tasks. Of the 2 girls scoring above the sample mean, 1 passed 3 of the tasks and the other passed all 4. Again, the pattern of results is suggestive of the majority of the group scoring below average, with a handful at a very low level and one or two performing at a very high level.

Figure 4.8: time 2 theory of mind

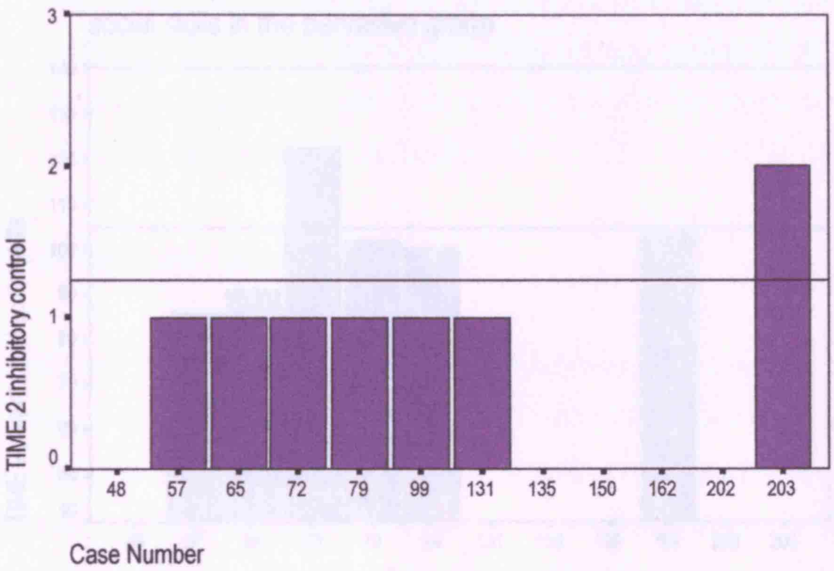
in the pervasive group



Results for the IC composite are difficult to decipher (figure 4.9). 6 of the 7 children for whom data were available passed 1 of the tasks, below the mean score of 1.25 in the whole sample, though since the sample mean was so low it is difficult to determine the extent of the deficit in these children.

Figure 4.9: Time 2 inhibitory control

in the pervasive group



Finally, figures 4.10 and 4.11 present the scores for the pervasive group on parent and teacher-rated social skills at time 2. Data were available for 6 children with regard to parent-rated social skills, and 5 of them fell below the sample mean of 104.75. None of the children fell below the population average range however, with the lowest score (a girl) being 86, in the low-average range. One child (a girl), scored 122, above the population average range. All 5 of the children for whom data were available scored below the sample mean of 103.19 on the teacher-rated social skills measure. 3 of the children (all girls) also scored below the population average range, with the lowest score being 79.

In general, the pattern of results is suggestive of continued high levels of conduct problems in the pervasive group, and poor functioning with regard to levels of hyperactivity, cognition and social skills. However, one or two of the children were functioning above the sample and population mean on many of the measures, whilst a handful of children were functioning in the borderline/learning disability range on some of the measures, constituting a particularly poor prognosis. Without a large enough group to analyse statistically we cannot determine whether as a group the "pervasive" children were performing significantly more poorly than the "low risk" or "situational" groups, but the pattern of results suggests that in general there is still cause for concern about these children.

Figure 4.10: Time 2 parent-rated social skills in the pervasive group

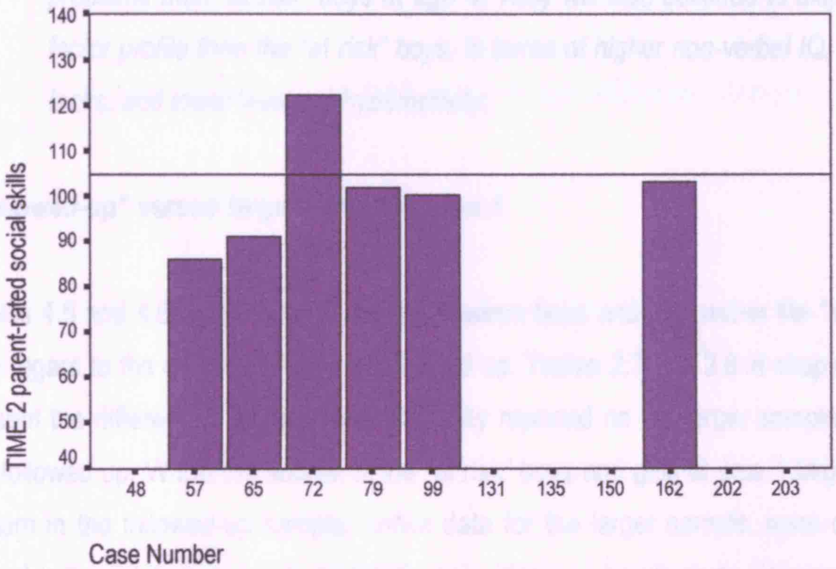
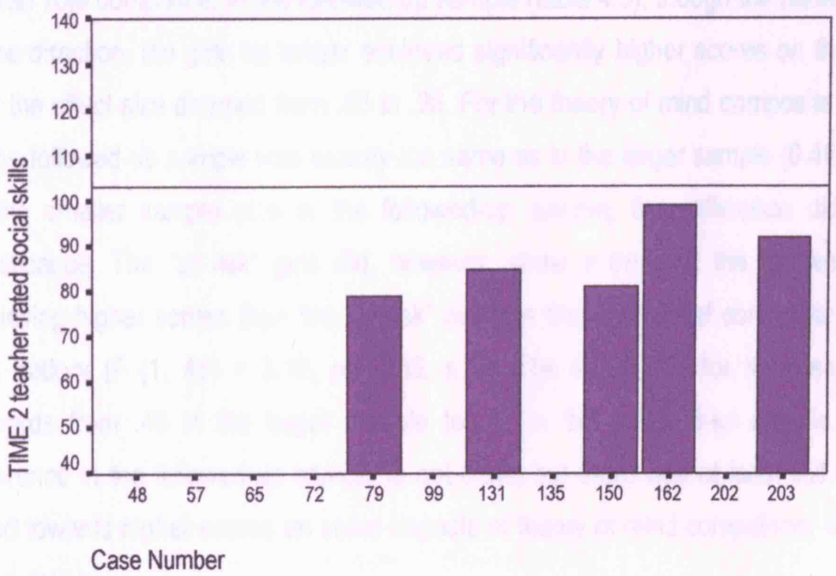


Figure 4.11: Time 2 teacher-rated social skills in the pervasive group



4.3.3 Oneway ANOVAs comparing boys and girls within the "at risk" group on cognitive and behavioural risk factors at time 2 (age 4)

Objectives and hypotheses: *"At risk" girls will show significantly lower levels of conduct problems than "at risk" boys at age 4. They will also continue to display a less severe risk factor profile than the "at risk" boys, in terms of higher non-verbal IQ, higher scores on ToM tasks, and lower levels of hyperactivity.*

"Followed-up" versus larger sample at time 1

Tables 4.5 and 4.6 detail the differences between boys and girls within the "at risk" group at time 1 with regard to the children who were followed up. Tables 2.7 and 2.8 in chapter 2 on the other hand present the differences as they were originally reported on the larger sample, some of whom were not followed up. Whilst the scores of the "at risk" boys and girls at time 1 largely reflected the same pattern in the followed-up sample, unlike data for the larger sample, none of the differences with regard to the risk factors reached statistical significance, though some approached significance.

More specifically, in the larger sample at time 1 it was reported that girls in the "at risk" group showed significantly higher scores than "at risk" boys on the Wellman composite of the theory of mind test battery, and a trend (though not statistically significant) towards higher scores for the overall ToM composite. In the followed-up sample (table 4.5), though the pattern of results was in the same direction, the girls no longer achieved significantly higher scores on the Wellman composite, and the effect size dropped from .53 to .26. For the theory of mind composite overall, the effect size in the followed-up sample was exactly the same as in the larger sample (0.46), though perhaps due to the smaller sample size in the followed-up sample, this difference did not reach statistical significance. The "at risk" girls did, however, show a trend in the followed-up sample towards achieving higher scores than the "at risk" boys on the false belief composite of the theory of mind test battery ($F(1, 45) = 3.10$, $p=0.085$, n.s.). The effect size for this gender difference shifted upwards from .46 in the larger sample to .51 in the followed-up sample. The reason for this difference in the followed-up sample is not clear, but there was at least still some suggestion of a trend towards higher scores on some aspects of theory of mind competency in "at risk" girls relative to "at risk" boys.

In the larger sample at time 1 it was reported that "at risk" girls showed a non-significant trend towards higher non-verbal IQ than "at risk" boys. Although this pattern of results was still evident in the followed-up sample (table 4.5), the differences did not approach significance and the effect size fell from 0.46 in the larger sample to an even weaker 0.34 in the followed-up sample.

Table 4.5: Boys v girls within "at risk" group (those with time 2 data) on cognitive risk factors at time 1

	Boys (N=21)	Girls (N=30)				
Risk factor	Mean (SD)	Mean (SD)	Effect size	Significant difference?	*Covaried for T1 NVIQ and verbal ability*	*Covaried for T1 hyp*
Non-verbal IQ◊	87.00 (19.02) N=20	93.32 (17.91) N=28	0.34	n.s.	*n.s.*	*n.s.*
Verbal ability ◊◊	87.25 (21.44) N=20	86.71 (17.90) N=28	0.03	n.s.	*n.s.*	*n.s.*
ToM	1.50 (1.00) N=20	2.04 (1.28) N=26	0.46	n.s.	*n.s.*	*n.s.*
ToM – Wellman composite	1.15 (.81) N=20	1.41 (.69) N=27	0.26	n.s.	*n.s.*	*n.s.*
ToM – False belief composite	.30 (.47) N=20	.65 (.80) N=26	0.51	p=0.085	*p=0.094*	*n.s.*
IC	.35 (.67) N=20	.69 (.84) N=26	0.44	n.s.	*n.s.*	*n.s.*

*p<0.05; **p<0.01; ***p<0.001

◊Only covaried for verbal ability; ◊◊Only covaried for non-verbal IQ

In the larger sample at time 1 "at risk" boys displayed significantly higher levels of experimenter-rated hyperactivity than "at risk" girls. This difference still approached significance in the followed-up sample ($F(1, 48) = 3.82$, $p=0.057$, n.s.), and the effect size of .67 in the larger sample was still moderate in the followed-up sample (.55). However, whilst in the larger sample this gender difference was independent of any gender differences in verbal and non-verbal ability at time 1, in the followed-up sample the difference no longer approached significance when controlling for non-verbal and verbal ability (see table 4.6).

The largely non-significant differences in the followed-up sample could reflect the smaller sample size, or the possibility that the children followed up were not representative of the original sample in terms of the gender differences that were present. Thus, perhaps the poor-functioning "at risk" boys or the high-functioning "at risk" girls were under-represented in the followed-up sample.

It emerged that within the "at risk" group, though this was not addressed in the larger sample in chapter 2, the boys presented with significantly higher levels of parent-rated conduct problems ($F(1, 50) = 7.75$, $p<0.01$, see table 4.6), though there was no significant gender difference with regard to teacher-rated conduct problems. The extent to which these findings were maintained at time 2 can be addressed in the following section.

Table 4.6: Boys v girls within "at risk" group (those with time 2 data) on behavioural risk factors at time 1

	Boys (N=21)	Girls (N=30)				
Risk factor	Mean (SD)	Mean (SD)	Effect size	Significant difference?	*Covaried for T1 NVIQ and verbal ability*	*Covaried for T1 hyp*
Parent-rated conduct problems	5.43 (1.36) N=21	4.10 (1.86) N=30	0.74	**	**	*
Teacher-rated conduct problems	2.67 (2.47) N=15	3.04 (1.97) N=25	0.17	n.s.	*n.s.*	*n.s.*
Parent-rated social skills	90.24 (16.75) N=21	97.00 (15.93) N=30	0.41	n.s.	*n.s.*	*n.s.*
Teacher-rated social skills	92.08 (18.09) N=13	80.95 (14.09) N=19	0.67	p=0.060	*n.s.*	*p=0.051*
Parent-rated hyp	3.81 (2.32) N=21	3.73 (2.59) N=30	0.03	n.s.	*n.s.*	*N/A*
Teacher-rated hyp	3.87 (2.75) N=15	4.20 (2.68) N=25	0.12	n.s.	*n.s.*	*N/A*
Exptr-rated hyp	14.52 (7.61) N=21	10.93 (5.27) N=28	0.55	p=0.057	*n.s.*	*N/A*

*p<0.05; **p<0.01; ***p<0.001

Main analyses

Tables 4.7, 4.8 and 4.9 detail the performance of the "at risk" girls and "at risk" boys across all cognitive and behavioural risk factors at time 2. "At risk" girls showed a non-significant trend at time 2 towards achieving higher non-verbal IQ scores than "at risk" boys (F (1, 46) = 2.85, p=0.098, n.s, see table 4.7). Both boys and girls obtained mean scores within the population average range (girls: 101.79, boys: 91.83), though the boys' mean score was two-thirds of a standard deviation below that of girls, with a moderate effect size of 0.50. The difference was no longer significant, however, when time 1 hyperactivity (F (1, 33) = 0.085, n.s.) was covaried for. Experimenter-rated hyperactivity at time 1 emerged as a significant covariate effect (F (1,33) = 4.20, $p<0.05$). This apparent trend indicative of a gender difference in non-verbal ability could in fact be due to the gender difference in levels of hyperactivity at time 1. Thus, boys' higher levels of hyperactivity at age 3 could be associated with boys' poorer non-verbal IQ at age 4, and hence it is the difference in levels of hyperactivity between boys and girls, rather being male versus female per se, that accounts for the differences in age 4 non-verbal ability between "at risk" boys and "at risk" girls.

The overall theory of mind composite did not reveal significant gender differences at time 2. However, the "at risk" girls did show significantly better performance than the "at risk" boys on the Wellman composite of the theory of mind test battery (F (1, 46) = 5.33, $p<0.05$, see table 4.7), with girls' mean score reflecting a tendency to pass both tasks (1.62) and boys' mean score closer to 1 (1.17). The effect size of 0.66 indicated a moderate magnitude of difference, which continued to approach significance even after controlling for time 1 hyperactivity (F (1, 33) = 2.97, p=0.095, n.s.).

It emerged that a non-significant trend in the direction of poorer performance on IC tasks by "at risk" boys than "at risk" girls was evident at time 2 (F (1, 46) = 3.72, p=0.060, n.s.). The effect size of 0.57 was suggestive of a moderate magnitude of difference. When the individual IC tasks were analysed separately (table 4.8), it was revealed that "at risk" girls had a significantly higher pass rate than "at risk" boys on the Day/Night task (χ^2 (1, 47) = 4.24, $p<0.05$). Again, results from the ANCOVA were consistent with the notion that higher levels of hyperactivity in the "at risk" boys at time 1 might account for the gender difference in IC (F (1, 33) = 2.16, n.s.). Specifically, the covariate effect for time 1 parent-rated hyperactivity was significant (F (1, 33) = 5.01, $p<0.05$).

Table 4.7: Boys v girls within "at risk" group on cognitive risk factors at time 2

	Boys (N=21)	Girls (N=30)				
Risk factor	Mean (SD)	Mean (SD)	Effect size	Significant difference?	*Covaried for T1 NVIQ and verbal ability*	*Covaried for T1 hyp*
Non-verbal IQ◊	91.83 (20.83) N=18	101.79 (18.92) N=29	0.50	p=0.098	*	*n.s.*
Verbal ability ◊◊	92.72 (18.13) N=18	96.83 (16.98) N=29	0.24	n.s.	*n.s.*	*n.s.*
ToM	2.33 (1.46) N=18	2.66 (1.05) N=29	0.27	n.s.	*n.s.*	*n.s.*
ToM – Wellman	1.17 (.86) N=18	1.62 (.49) N=29	0.66	*	*	*p=0.095*
ToM – False Belief	1.28 (.83) N=18	1.03 (.78) N=29	0.31	n.s.	*n.s.*	*n.s.*
IC	.83 (.86) N=18	1.28 (.70) N=29	0.57	p=0.060	*p=0.089*	*n.s.*

*p<0.05; **p<0.01; ***p<0.001
◊Only covaried for T1 verbal ability; ◊◊Only covaried for T1 non-verbal IQ

Table 4.8 Boys versus girls within "at risk" group on individual IC tasks (pass/fail) at time 2

	Luria's Handgame		χ^2	Day/ Night		χ^2
	Pass	Fail		Pass	Fail	
Boys	11 (61%)	7 (39%)	n.s.	5 (28%)	13 (72%)	*
Girls	19 (66%)	10 (34%)		17 (59%)	12 (41%)	

*p<0.05

Table 4.9: Boys v girls within "at risk" group on behavioural risk factors at time 2

Risk factor	Boys (N=21) Mean (SD)	Girls (N=30) Mean (SD)	Effect size	Significant difference?	*Covaried for T1 NVIQ and verbal ability*	*Covaried for T1 hyp*
Parent-rated conduct problems	4.75 (2.12) N=8	3.32 (1.76) N=22	0.74	p=0.072	*	**
Teacher-rated conduct problems	2.07 (2.15) N=15	2.29 (2.47) N=21	0.10	n.s.	*n.s.*	*n.s.*
Parent-rated social skills	98.88 (14.09) N=8	99.00 (10.21) N=22	0.01	n.s.	*n.s.*	*n.s.*
Teacher-rated social skills	100.73 (21.02) N=15	96.85 (13.23) N=20	0.23	n.s.	*n.s.*	*n.s.*
Parent-rated hyp	4.50 (1.60) N=8	3.45 (2.79) N=22	0.41	n.s.	*n.s.*	*N/A*
Teacher-rated hyp	4.53 (3.27) N=15	2.86 (3.07) N=21	0.52	n.s.	*n.s.*	*N/A*
Exptr-rated hyp	11.56 (4.68) N=18	10.17 (4.60) N=29	0.30	n.s.	*n.s.*	*N/A*

*p<0.05; **p<0.01; ***p<0.001

Table 4.9 reveals that no significant gender differences emerged within the "at risk" group at time 2 with regard to parent or teacher-rated social skills, or with regard to any aspect of hyperactivity. However, as hypothesised, there did remain a non-significant trend in the direction of higher levels of parent-rated conduct problems in "at risk" boys compared with "at risk" girls ($F(1, 29) = 3.50$, $p=0.072$, n.s.), with boys presenting with a mean score of 4.75, above the population 95th percentile, and girls presenting with a mean score of 3.32, above the population 90th percentile. The effect size of 0.74 denotes a moderate magnitude of difference. No significant gender differences were evident with regard to teacher-rated conduct problems.

Levels of conduct problems at time 2 showed a slight decrease for boys and girls. However, there still remained a non-significant trend towards higher levels of parent-rated conduct problems in boys relative to girls ($F(1,29) = 3.50$, $p=0.072$, n.s.). The effect size of 0.72 was the same as at time 1, indicating that the magnitude of difference remained similar across the two time-points. More detailed consideration of the absolute level of conduct problems in the "at risk" boys and girls shall follow in the discussion.

Summary of results: *Results were largely consistent with hypotheses. Girls in the "at risk" group showed a significantly higher pass rate than boys in the "at risk" group with regard to the Wellman composite of the ToM test battery and the Day/Night task within the IC test battery. "At risk" girls also displayed a trend towards higher non-verbal IQ than "at risk" boys, though this difference did not reach statistical significance. Boys no longer displayed significantly higher levels of hyperactivity. Hyperactivity at time 1 accounted for much of the gender differences in cognitive functioning within the "at risk" group at time 2. A non-significant trend towards elevated levels of parent-rated conduct problems at time 2 in "at risk" boys relative to "at risk" girls emerged.*

4.3.4 "Desisters" and "Persisters": Descriptive statistics

> ***Objectives and hypotheses:*** *A greater proportion of "at risk" males than "at risk" females will be "persisters".*

Table 4.10 details the number of children falling into the three "conduct" categories at time 1 ("low risk": below the population 70th percentile on both parent and teacher SDQ conduct problems sub-scales, "middle": falling between the two cut-off points, and "at risk": above the population 90th percentile on either the parent or the teacher (or both) SDQ conduct problems sub-scales) and their categorisation according to the same criteria at time 2. The first point to note is that only 3 children moved from being "low risk" at time 1 to being "at risk" at time 2, and similarly only 3 children moved from being "at risk" at time 1 to "low risk" at time 2. This latter group are strictly speaking the only "true" desisters in the sample, since their scores on the conduct problems sub-scale have shifted from being above the population 10th percentile and therefore of concern in terms of the potential for later problems, to being below the population 70th percentile and therefore deemed at "low risk".

Since the numbers of "true" desisters were so small, desisters were defined as those children in the "at risk" group at time 1 who moved into the "middle" group or the "low risk" group at time 2. The label "desister" should therefore be interpreted cautiously since it does not necessarily constitute a huge behavioural shift to move from the "at risk" to the "middle" group (i.e. the score from age 3 to age 4 for conduct problems could differ by as little as one point only, by one rater, to constitute a move from the "at risk" to the "middle" group). 23 children fell in to the "desisters" category.

The "persisters" were those children in the "at risk" group at time 1 whose behaviour on the conduct problems sub-scale continued to fall above the population 90th percentile on at least one of the questionnaires at time 2, and thus they remained in the "at risk" group. 21 children fell into this category. Nevertheless, just as it is not the case that the "desisters" are true desisters, it is also true that the persisters are not true persisters in the sense that there is no evidence that their conduct problems will persist into adolescence or adulthood. These categories simply reflect behavioural continuity or discontinuity across a very small time-span. It remains to be seen whether such short-term continuity might signify significant implications for long-term outcome. These issues aside, from this very crude categorisation it would seem that children at age 3 were equally likely to continue to display significant conduct problems as they were to discontinue such behaviour.

It is clear from table 4.11 that boys and girls in the "at risk" group at time 1 (at least those who were followed up) were equally likely to be "persisters" as they were to be "desisters". Half of the girls and half of the boys fell into each category at time 2 (χ^2 (1,44) = 0.05, n.s.). Thus, at least in terms of the definitions used here, girls were not in fact more likely to desist than boys. Given the small numbers of boys and girls in each of the categories it was not possible to conduct separate analyses for male and female persisters and desisters due to the limited power of such small sample sizes.

Table 4.10 Proportion of children in "at risk" "middle" and "low risk" groups at time 1 and time 2

	Time 2 Low risk	Time 2 Middle	Time 2 At risk	Total N (%)
Time 1 Low risk N (%)	10 (36%)	14 (50%)	3 (11%)	27
Time 1 Middle N (%)	20 (30%)	30 (45%)	16 (24%)	66
Time 1 At risk N (%)	3 (7%)	20 (45%)	21(48%)	44
Total N	33	64	40	137

Table 4.11 Proportion of male and female "desisters" and "persisters"

	Desisters	Persisters	Total N (%)
Male N (approx. %)	8 (50%)	8 (50%)	16 (100%)
Female N (approx. %)	15 (54%)	13 (46%)	28 (100%)
Total N	23	21	44

Summary of results: *23 desisters and 21 persisters were identified from the group of children in the "at risk" group at time 1. Thus, it was equally likely that 3-year-olds with conduct problems would continue or discontinue to display conduct problems a year later. In addition, contrary to the hypothesis, equal proportions of "at risk" boys and girls were were persisters and desisters.*

4.3.5 Oneway ANOVAs comparing "desisters" and "persisters" on cognitive and behavioural risk factors at time 1 (age 3) and time 2 (age 4)

Objectives and hypotheses: *Desisters are predicted to have presented with a significantly less severe risk factor profile at age 3 than persisters and to present with a significantly less severe risk factor profile at age 4 than persisters. Verbal ability, conduct problems and hyperactivity are expected to emerge as important risk factors in differentiating desisters and persisters.*

Tables 4.12 and 4.13 present the data pertaining to the cognitive and behavioural risk factor profiles of the persisters and desisters at time 1. No significant differences were detected across any of the risk factors between the desisters and the persisters at age 3, and thus no predictors of persisting versus desisting were established using the available measures. Possibly the small sample sizes in these analyses contributed to the low power to detect significant differences, since on 2 of the measures moderately large effect sizes were found (see teacher-rated conduct problems and teacher-rated hyperactivity in table 4.13).

For example, the mean score for teacher-rated conduct problems at age 3 for desisters was 2.39, which would constitute a rating above the population 83rd percentile for a boy and 92nd percentile for a girl. The mean score for persisters on the other hand was 3.50, placing both boys and girls above the above the population 90th percentile (91st percentile for boys and 97th percentile for girls). With a moderate effect size of 0.51 it is possible that given a larger sample size this difference may have reached significance ($F(1, 34) = 2.44$, n.s.). Similarly, the mean score for teacher-rated hyperactivity at age 3 was 3.33 for desisters which is well below the population 90th percentile cut-off for boys and girls (54th perecntile for boys, 76th percentile for girls) whilst the mean score of 4.56 for persisters is nearing the 90th percentile cut-off for girls (86th percentile) and reaches the 67th percentile for boys. The effect size for this difference was 0.46 ($F(1, 34) = 1.95$, n.s.), and the difference approached significance once the effects of time 1 non-verbal and verbal cognitive ability were statistically controlled for.

Thus, there was some indication that persisters showed higher levels of teacher-rated conduct problems and hyperactivity than desisters at age 3, with moderately large magnitudes of difference between the groups. These differences did not reach significance, yet this could have been due to the small sample size. Each group in these analyses consists of just half the followed-up "at risk" sample, and hence the sample sizes in these and the gender difference analyses are half the size of the "at risk" versus "low risk" analyses, with less power to detect significant differences.

Table 4.12: Desisters" v "Persisters" on cognitive risk factors at time 1

	Desisters (N=23)	Persisters (N=21)				
Risk factor	Mean (SD)	Mean (SD)	Effect size	Significant difference?	*Covaried for T1 NVIQ and verbal ability*	*Covaried for T1 hyp*
Non-verbal IQ◊	89.96 (17.11) N=23	93.74 (18.50) N=19	0.21	n.s.	*n.s.*	*n.s.*
Verbal ability ◊◊	85.65 (17.48) N=23	89.11 (19.38) N=19	0.19	n.s.	*n.s.*	*n.s.*
ToM	2.14 (1.11) N=21	1.79 (1.18) N=19	0.31	n.s.	*n.s.*	*n.s.*
IC	.52 (.68) N=21	.58 (.90) N=19	0.08	n.s.	*n.s.*	*n.s.*

*p<0.05; **p<0.01; ***p<0.001
◊Only covaried for verbal ability; ◊◊Only covaried for non-verbal IQ

Table 4.13: "Desisters" v "Persisters" on behavioural risk factors at time 1

	Desisters (N=23)	Persisters (N=21)				
Risk factor	Mean (SD)	Mean (SD)	Effect size	Significant difference?	*Covaried for T1NVIQ and verbal ability*	*Covaried for T1 hyp*
Parent-rated conduct problems	4.35 (1.70) N=23	4.86 (1.53) N=21	0.32	n.s.	*n.s.*	*n.s.*
Teacher-rated conduct problems	2.39 (1.79) N=18	3.50 (2.43) N=18	0.51	n.s.	*n.s.*	*n.s.*
Parent-rated social skills	92.13 (13.59) N=23	97.62 (17.61) N=21	0.35	n.s.	*n.s.*	*n.s.*
Teacher-rated social skills	84.56 (18.53) N=16	85.17 (15.67) N=12	0.02	n.s.	*n.s.*	*
Parent-rated hyp	3.26 (2.22) N=23	4.05 (2.43) N=21	0.32	n.s.	*n.s.*	*N/A*
Teacher-rated hyp	3.33 (2.30) N=18	4.56 (2.30) N=18	0.46	n.s.	*p=0.09*	*N/A*
Exptr- rated hyp	11.13 (5.01) N=23	12.79 (7.18) N=19	0.27	n.s.	*n.s.*	*N/A*

*p<0.05; **p<0.01; ***p<0.001

With regard to the functioning of desisters and persisters at time 2 (tables 4.14 and 4.15), it emerged that persisters presented with a significantly higher pass-rate on theory of mind tasks than desisters at time 2 ($F(1, 38) = 4.80$, $p<0.05$, see table 4.14). Thus, although their behaviour in terms of conduct problems was significantly worse than desisters, persisters were advanced in comparison to desisters on tasks measuring the capacity to understand the behaviour and intentions of others. This difference remained significant even when covarying for time 1 non-verbal and verbal ability ($F(1, 37) = 4.51$, $p<0.05$), and when covarying for time 1 hyperactivity ($F(1, 29) = 5.03$, $p<0.05$), suggesting that differences in verbal and non-verbal ability or hyperactivity at time 1 between persisters and desisters did not account for the significant difference in ToM task performance at time 2.

Table 4.14: "Desisters" v "Persisters" on cognitive risk factors at time 2

	Desisters (N=23)	Persisters (N=21)				
Risk factor	Mean (SD)	Mean (SD)	Effect size	Significant difference?	Covaried for T1 NVIQ and verbal ability	*Covaried for T1 hyp*
Non-verbal IQ◊	102.90 (13.60) N=21	97.84 (20.00) N=19	0.27	n.s.	n.s.	*n.s.*
Verbal ability ◊◊	95.10 (13.60) N=21	96.79 (18.02) N=19	0.11	n.s.	n.s.	*p=0.058*
ToM	2.24 (1.26) N=21	3.00 (.88) N=19	0.66	*	*	*
IC	1.24 (.77) N=21	1.05 (.78) N=19	0.25	n.s.	n.s.	*n.s.*

*p<0.05; **p<0.01; ***p<0.001
◊Only covaried for T1 verbal ability; ◊◊Only covaried for T1 non-verbal IQ

Table 4.15 reveals that persisters had significantly higher levels of both parent and teacher-rated conduct problems at age 4 (Parent-rated conduct problems: $F (1, 27) = 25.68$, $p<0.001$; Teacher-rated conduct problems: $F (1, 32) = 75.18$, $p<0.001$). Effect sizes for both parent-rated (1.38) and teacher-rated (1.25) conduct problems were equally large, indicating that the difference between persisters and desisters with regard to levels of conduct problems was not larger in magnitude for one rating than the other. The mean score of 4.94 for parent-rated conduct problems in the persisters places the children above the population 95th and 98th percentiles for boys and girls respectively, clearly denoting a high degree of pathology. This was compared to the mean score of 2.23 in the desisters, reflecting a score above the population 72nd percentile for boys and 79th percentile for girls. A similar pattern was evident with regard to teacher-rated conduct problems. The mean score of 3.81 in the persisters places them above the 93rd (boys) and 97th (girls) percentiles, showing that for both parent and teacher-rated conduct problems the level of pathology in the persisters was above the 90th percentile. In contrast the mean score of 0.83 in the desisters for teacher-rated conduct problems is consistent with a score above the population 55th (boys) and 74th (girls) percentiles.

Once non-verbal ability and verbal ability were partialled out of the equation, persisters presented with significantly higher levels of parent-rated hyperactivity at age 4 than desisters ($F (1,27) = 4.71$, $p<0.05$). Furthermore, there emerged a non-significant trend towards higher levels of teacher-rated hyperactivity at time 2 in persisters relative to desisters ($F (1, 32) = 3.73$, $p=0.06$). The effect sizes for both parent and teacher-rated hyperactivity were moderate (0.56 and 0.54 respectively) indicating that the magnitude of difference between the two groups was not small. Thus, persisters not only persisted in terms of conduct problems, but moreover their persistent conduct problems were associated with elevated levels of hyperactivity at age 4. Indeed, the mean score of 2.85 for parent-rated hyperactivity in the desisters equates to a score above the population 45th percentile for boys and 60th percentile for girls. The mean score of 4.25 in the persisters on the other hand corresponds to a score above the population 60th percentile for boys and 74th percentile for girls. Similarly, the mean score of 2.56 with regard to teacher-rated hyperactivity in the desisters equates to a score above the population 47th percentile for boys and 70th percentile for girls, whereas the mean score for the persisters of 4.25 is consistent with a score above the population 62nd percentile for boys and 84th percentile for girls.

Table 4.15: "Desisters" v "Persisters" on behavioural risk factors at time 2

	Desisters (N=23)	Persisters (N=21)				
Risk factor	Mean (SD)	Mean (SD)	Effect size	Significant difference?	*Covaried for T1 NVIQ and verbal ability*	*Covaried for T1 hyp*
Parent-rated conduct problems	2.23 (.93) N=13	4.94 (1.73) N=16	1.38	***	***	***
Teacher-rated conduct problems	.83 (.92) N=18	3.81 (2.54) N=16	1.25	***	***	***
Parent-rated social skills	97.69 (8.48) N=13	101.50 (11.59) N=16	0.37	n.s.	*n.s.*	*n.s.*
Teacher-rated social skills	103.00 (14.82) N=17	97.06 (15.70) N=16	0.39	n.s.	*n.s.*	*n.s.*
Parent-rated hyp	2.85 (1.73) N=13	4.25 (2.91) N=16	0.56	n.s.	*	*N/A*
Teacher-rated hyp	2.56 (2.33) N=18	4.25 (3.68) N=16	0.54	n.s.	*p=0.06*	*N/A*
Exptr-rated hyp	9.71 (4.27) N=21	11.32 (5.15) N=19	0.34	n.s.	*n.s.*	*N/A*

*p<0.05; **p<0.01; ***p<0.001

Summary of results: *None of the cognitive or behavioural risk factors at time 1 significantly differentiated the persisters from the desisters, despite moderately strong effect sizes in the direction of higher levels of teacher-rated conduct problems and teacher-rated hyperactivity at time 1 in persisters relative to desisters.*

At time 2 persisters presented with significantly higher ratings than desisters on both parent and teacher-rated conduct problems. They also showed a trend towards higher levels of parent and teacher rated hyperactivity at time 2 compared with desisters. Nevertheless, they also displayed significantly advanced theory of mind skills in comparison to desisters at time 2 despite their poorer behavioural profile.

4.4 Discussion

4.4.1 "At risk" versus "low risk" children at age 4

Our retention rate in terms of the number of children with at least one piece of follow-up data was 72%. In a review of longitudinal studies on child antisocial behaviour, a retention rate of 52 – 100%, with a median of 75% was reported (Capaldi & Patterson, 1987), which is comparable with the present study. However, many larger-scale longitudinal studies have reported much higher retention rates (e.g. 83% in the Pittsburgh Youth Study, Loeber et al, 2001), often due to large teams of researchers working on the projects and monetary rewards for continued participation, neither of which were possible in the present study. It is of particular importance that high retention rates are obtained in longitudinal studies of children with antisocial behaviour, since in this population it is often the case that non-responders and those least likely to engage in the research are families of delinquent and antisocial children (Farrington, Gallagher,Morley, Ledger & West, 1990). Thus even with the limited resources available in the present study, every attempt was made to maximise the number of families participating in the follow-up phase of the study.

It was hypothesised that children in the "at risk" group at time 1 would continue to display significantly higher levels of conduct problems than their "low risk" peers a year later at age 4. This was based on previous research indicating that early-onset behaviour problems are predictive of continued problems throughout the life span (Moffitt, 1993; Farrington, 1995) and that behaviour problems evident as early as age 3 predict significant behaviour problems a year later above and beyond those shown by children who did not display behaviour problems at age 3 (Richman et al, 1982). Results supported the hypothesis in that there was still a significant difference between the "at risk" and "low risk" groups with regard to levels of both parent and teacher-rated conduct problems at age 4. The "at risk" group displayed significantly higher levels of conduct problems than the "low risk" group, which for both ratings and for both genders were elevated enough to be above at least the population 89th percentile.

Nevertheless, whilst the group difference with regard to levels of conduct problems remained significant at time 2, the magnitude of difference was smaller than at age 3, with the mean scores on the conduct problems sub-scales increasing from age 3 to age 4 for the "low risk" group, and decreasing for the "at risk" group thus narrowing the gap between them. The "at risk" group at time 2 were still, however, functioning at a level above the population 90th percentile according to parents' ratings, and for teachers' ratings with regard to girls. Boys were also still above the population 80th percentile according to teacher ratings of conduct problems. Thus, the level of pathology was still high, and still significant in terms of the population norms.

It is plausible that "regression to the mean" could account for the finding that the mean conduct scores in the "at risk" group showed a slight reduction over time, since the "at risk" group's level of functioning at time 1 was further from the population mean than that of the "low risk" group. This would mean that, if measured again, the "at risk" group would be more likely to shift further towards the mean than the "low risk" group. It is also possible that remedial interventions in the nurseries or at home had focused on children with high levels of conduct problems and thereby had managed to engender some form of behavioural change during the course of the year. One further explanation, and perhaps the most likely, is that a proportion of the age 3 "at risk" children were displaying transient conduct problems which were temporary and had subsided by age 4. This would account for a decrease in the mean level of conduct problems for the "at risk" group overall, even if many of the children continued to display high levels of conduct problems.

In terms of the risk factor profiles of the "at risk" and "low risk" groups at time 2, we hypothesised that the "at risk" group would continue to display significantly poorer functioning than the "low risk" group on measures of verbal ability, and begin to present with poorer functioning on ToM and IC measures. They were also predicted to present with continued impairments in social skills and elevated levels of hyperactivity relative to the "low risk" group.

With regard to verbal ability it is notable that higher mean scores for both groups were apparent at time 2 than at time 1, particularly amongst the "at risk" group. Mean verbal ability in the "at risk" group, for example, was 86.94 at time 1 in the followed-up sample (and 86.33 in the larger sample), placing the children in the low-average range, whereas the mean score at time 2 was 95.26, which is within the mid-average range. What might be the explanation for this higher mean score at age 4, given that all of the measures are standardised and hence should not be subject to significant change over time? One explanation that was considered was the possibility that the children who were tested in schools at time 2 performed better on the measures than those tested in nurseries since they were in optimal conditions in which often a separate room was available and other children were engaged in set tasks and thus interrupted the sessions less often than in the nurseries.

Thus perhaps the results of the standardised tests conducted in nurseries were confounded by unfavourable testing conditions and did not allow children to perform to their full potential. Two pieces of evidence discount this theory. Firstly when children in school at time 2 were compared to children in nursery at time 2 on all of the measures, no significant differences emerged in terms of their levels of functioning (see appendix K). Secondly being in optimal testing conditions for the experimenter-administered tasks would not explain why teachers, and even less so parents, would also elevate their ratings of children's social skills from age 3 to age 4. It is possible of course that regression to the mean could also account for the higher scores in verbal ability at time 2. Also tenable is the hypothesis that interventions in place at the nurseries and schools in these deprived areas of London may have had an impact on children's functioning more generally, producing improvements across the board by age 4. This seems unlikely, however, given how difficult it is for even very carefully controlled intervention studies to demonstrate significant improvements in children's functioning.

These issues aside, nonetheless there emerged, as hypothesised, a significant difference in the verbal ability of the "at risk" group compared with the "low risk" group at age 4, albeit of a smaller magnitude to that found at age 3. That is to say that the "at risk" group, although demonstrating higher verbal ability scores than those achieved at time 1, were still functioning at a significantly lower level in terms of verbal ability at time 2 than children in the "low risk" group. It is questionable the extent to which one might argue that verbal ability in the mid-average range might constitute risk for poor outcome even if it is significantly lower than that of their "low risk" peers. However, Lahey et al's (2002) study reported that having a verbal IQ above the average range (115 or above) represented a protective factor against the continuity of conduct disorder, and thus the fact that the "at risk" group were still well below this level at age 4 could mean that they may not stand to benefit from even such a significant improvement in verbal ability. Richman et al (1982), in line with the present findings, reported that whilst their "behaviour problem" group continued to evidence poorer cognitive functioning than their control group at their age 4 1-year follow-up, the differences were less marked than at age 3. Thus it seems that possibly presenting with behaviour problems very early in development may not impede a child's potential to "catch up" with their peers in terms of cognitive functioning, and this might suggest that Moffitt's (1993) "early starter model" may not be applicable to children of pre-school age, since it seems that the early impairments associated with behaviour problems at age 3 are no longer as severe by age 4. It remains to be seen how likely the "at risk" group will be to maintain these improvements in cognitive and social functioning, given that their conduct problems and hyperactivity still persist. Perhaps longer-term outcome studies will be necessary to decipher the impact of cognitive "catch-up" if it can be termed in such a way, on already persistent conduct problems in the pre-school years.

One further point to note with regard to the poorer verbal ability in the "at risk" group compared with the "low risk" group at time 2 is that the group difference did not remain significant after covarying for time 1 non-verbal ability or hyperactivity. This indicates that differences between the "at risk" and "low risk" groups with regard to general intellectual functioning (not limited to verbal ability) and hyperactivity at age 3 may have accounted for the differences in verbal ability at age 4. This is inconsistent with findings reported at age 3, whereby high levels of conduct problems specifically, regardless of levels of hyperactivity or non-verbal ability, were associated with poorer verbal ability. This could mean that the specific association between verbal ability and conduct problems is only applicable to 3-year-olds, and that as soon as a year later, other factors are as likely if not more likely to be associated with conduct problems. However, such a phenomenon has not been previously reported. In fact, most studies pertaining to the specific link between verbal ability and conduct problems have been concerned with older children (e.g. Moffitt, 1990). It is possible that in this particularly high risk sample of children, early conduct problems, even if arising from predominantly verbal deficits, lead to deficits in other areas of functioning very quickly, such that verbal ability no longer stands out as the strongest associated risk factor by age 4. Nevertheless, if this were the case, we would not expect levels of verbal ability (as well as other risk factors to be discussed below) to show a general increase between the ages of 3 and 4. On the contrary, the theory would predict that overall levels of functioning would decline over the course of time. The finding is therefore difficult to interpret.

One further possible interpretation of the finding that there was no longer clear evidence of a specific verbal deficit amongst the "at risk" group at age 4, independently of hyperactivity, is that the nature of the verbal deficit may not have been captured by the receptive language instrument used in the present study. Gilmour, Hill, Place and Skuse (2004) hypothesised that a deficit in *pragmatic* language could underlie the antisocial behaviour displayed by children with conduct disorder. Pragmatic language refers to the appropriate use of language within the context in which it occurs (Bishop, 1997). The authors proposed that, in line with Moffitt et al's (2001) tentative conclusions from the Dunedin study, a relatively rare form of antisocial behaviour which begins early in life, could share the same neurodevelopmental origins as pervasive developmental disorders such as autism, which also have a large male preponderance. As an example, a child with a pragmatic language deficit would be unable to differentiate between the type of language appropriate to speaking to a peer, and that appropriate to addressing a person of authority such as a teacher. Speaking to an adult in a disrespectful way could thus be deemed insolent (Gilmour et al, 2004). Gilmour et al (2004) went on to test their hypothesis with several groups of children, all with a mean age of between 9 and 10 years: a conduct disordered group, a group of children with autistic spectrum disorder (ASD), another group diagnosed with autism, a typically developing group, and finally an antisocial sub-set of children excluded from school. They found that the children with conduct disorder and those excluded from school, evidenced pragmatic language impairments as severe as those with ASD and autism.

If this specific language deficit underlies conduct problems, then the BPVS measure of receptive vocabulary may not identify the core deficit. According to the pragmatic language deficit hypothesis, children with conduct problems would not necessarily present with a general language delay or limited vocabulary, but they would have difficulty using language *appropriately.* Having difficulty in interpreting language in context could conceivably lead to a delay in vocabulary acquisition, which could reflect the relative deficit in the "at risk" group at age 3. Nevertheless, it is possible that by age 4 they may have "caught up" with their peers in terms of vocabulary, but would still present with a difficulty in the pragmatic use of language not captured by the BPVS.

Whatever the explanation, the relative cognitive deficit at time 2 in the "at risk" group compared to the "low risk" group was not specific to verbal ability. Despite higher mean non-verbal IQ scores over time in both groups (bringing the "low risk" group from mid-average to high-average and the "at risk" group from low-average to mid-average), the magnitude of difference between the groups was greater at time 2 (effect size of 0.32 at time 1 compared to 0.51 at time 2). The "at risk" group's performance on the non-verbal tasks relative to the "low risk" group's was comparably poorer at age 4, and the difference reached significance. Again, being within the "average" range it is difficult to predict whether this relative impairment could predict poorer long-term outcome, but it certainly remains the case that the non-verbal ability of "at risk" children was significantly poorer than that of their "low-risk" peers. Also in line with findings regarding verbal ability at time 2, the group differences with regard to non-verbal ability at time 2 were not independent of differences in verbal ability or levels of hyperactivity at time 1 between the two groups.

Parent-rated social skills, as hypothesised, were significantly poorer in the "at risk" group relative to the "low risk" group at time 2, at a level around two-thirds of a standard deviation below the "low risk" group. Whilst both groups had higher mean scores at time 2 than at time 1, the magnitude of difference remained similar (effect size of 0.78 at time 1 and 0.79 at time 2). At both time points, therefore, the "at risk" group presented with significantly poorer social skills according to parents than the "low risk" group. The "at risk" group were functioning within the normal range at time 2 (mean score 98.97), and did not evidence a decrease in levels of social skills in relation to their time 1 scores. Therefore any theory indicating an increased deficit in social skills as a function of persisting conduct problems (e.g. via peer rejection as suggested by Vaghn et al, 1992) could not be supported by these data. However, relative to their low-risk peers, the "at risk" group were less socially skilled, which could still be a significant deficit within their social network. Being less socially skilled than the other children around them, even if they are not impaired relative to the population norms, could be enough to adversely affect peer group relations. Inability to communicate with "low-risk" children in their social network could lead them to associate with deviant peers, which has been shown to be associated with higher levels of antisocial behaviour and with later clinical behaviour disorders (Heinz, Toro & Urberg, 2004; LeBlanc, McDuff & Tremblay, 1994). As reported at time 1, the group difference could not be better accounted for by higher intellectual functioning at time 1 in the "low risk" group or by higher levels of hyperactivity at time 1 in the "at risk" group.

Results with regard to teacher-rated social skills were also consistent with the hypothesis. Children in the "at risk" group received significantly lower ratings at time 2 than children in the "low risk" group. Again, the difference was moderate (effect size 0.75), comparable to the difference at time 1 (effect size 0.89), and of just under a standard deviation apart. However, whereas at time 1 the "at risk" group were functioning at the low-average range (mean score 85.47), at time 2 they were well within the mid-average range (mean score 98.51). Whether this group difference could constitute a developmental disadvantage in terms of the future prognosis for the "at risk" group depends on whether the extent of the deficit is important, or moreover the relative deficit compared to peers within the child's social network. If the latter is the most important then clearly the children are still at risk. It is worth considering on the other hand that many intervention initiatives aimed at reducing conduct problems focus on improving social skills in the first instance, which has been shown to subsequently improve levels of conduct problems (Webster-Stratton et al, 2001). Thus it may be the case that such an upward shift in the social skills in the "at risk" group, whatever the reason for this may be, could lead to a consequent reduction in conduct problems in the future. Further follow-up assessments of this sample in the future might inform this theory.

Whilst the group difference with regard to teacher-rated social skills remained significant when covarying for time 1 verbal and non-verbal ability, it no longer reached significance when controlling for time 1 hyperactivity. This indicates that conduct problems at age 3 are negatively associated with social skills in the nursery setting according to teachers at age 4, and this association is not due to poorer cognitive functioning on the part of the "at risk" children at age 3 alongside their early emerging conduct problems. However, the higher levels of hyperactivity in the "at risk" group at age 3 may account for the poorer social skills they displayed at age 4 in comparison to the "low risk" group, rather than their relatively higher levels of conduct problems. Thus, perhaps hyperactivity levels at age 3 are a better predictor of social skills in the nursery setting a year later, whereas conduct problems at age 3 directly predict parent-rated social skills a year later.

Findings with regard to differences in levels of hyperactivity between the two groups at time 2 also confirmed the hypotheses. Children in the "at risk" group presented with significantly higher levels of parent and teacher-rated hyperactivity than the "low risk" children, and a pattern in the same direction for experimenter-rated hyperactivity approached significance. In terms of the extent of behavioural pathology in the "at risk" group, parent-rated hyperactivity levels corresponded to scoring above around the 60th percentile for boys and 70th – 80th percentile for girls with regard to parent and teacher-rated hyperactivity. This was clearly not as high as the level of pathology the group presented with in terms of conduct problems, and thus it does seem that the primary symptom of the "at risk" group at age 4 was still conduct problems.

The scores for the experimenter-rated measure of hyperactivity are not standardised but the lowest score obtainable (denoting very low levels of hyperactivity) is 7 and the highest is 37 (which would indicate extremely hyperactive and inattentive behaviour). The mean score on the HBRS in the "low risk" group was 8.93, at the lower end of the scale, and the mean score for the "at risk" group was 10.70. Our "at risk" and "low risk" groups did not differ as markedly as one comparable study using the HBRS to differentiate a group of children "at risk" for ADHD with a control group of "low risk" children aged between 4.5 and 6.5 years (Perner, Kain & Barchfield, 2002). The control group in Perner et al's study were slightly less hyperactive than in the present study, obtaining a mean score on the HBRS of 8.15, and the "at risk" group were more hyperactive than in the present study, with a mean score of 13.95. Being "at risk" for ADHD specifically rather than for conduct problems, one may have predicted that Perner et al's "at risk" group would be more hyperactive than the present "at risk" sample. Thus it does not seem that the scores on the HBRS in the present study reflect particularly unusual or surprising levels of hyperactivity.

Overall, significantly elevated levels of hyperactivity were evident at time 2 in the "at risk" group compared with the "low risk" group, and with regard to parent and teacher-rated hyperactivity the group difference was independent of the cognitive functioning of the two groups at time 1. This finding could therefore offer supportive evidence for the conjecture that the hyperactivity-conduct problems profile is predictive of continuity and is evident in the pre-school years (Lynam, 1996; Nigg & Huang-Pollock, 2003). This might therefore indicate that the prognosis for this early-identified group of children with symptoms of both conduct problems and hyperactivity could be particularly poor.

Thus far, the results have largely supported our prior hypotheses. However, we predicted that in addition to maintaining the relative profile of impairment on verbal ability, social skills and hyperactivity, the "at risk" group would also present with poorer functioning on ToM and IC tasks than the "low risk" group at time 2. At time 2 both groups' performances on the theory of mind composite had improved since time 1, yet there was no significant difference between the groups in terms of performance on these tasks. This finding is not consistent with Hughes et al's (1998) study, in which their 4-year-old "hard to manage" children did perform significantly poorly on ToM and IC tasks compared with the control group of children with no behaviour problems. One of Hughes et al's tasks was an emotion false belief task, in which the hard to manage children displayed a "skewed" theory of mind, consistent with Happé and Frith's (1996) notion of a "theory of nasty minds" in children with conduct problems. The "hard to manage" children were better at predicting a person's feelings following a "nasty" than a "nice" surprise, despite the fact that for the controls the "nice" surprise condition was the easiest to pass. It could be that mentalising tasks tapping this more emotionally-laden aspect of social understanding would be more fruitful at identifying the specific ToM deficit in children with conduct problems. Nevertheless, Hughes et al's (1998) "hard to manage" children did also show a deficit relative to the control group on the false belief tasks, which is more difficult to equate with the results in the present chapter.

Many previous studies have reported an association between mentalising ability and social competency, although for the most part have discussed this association in terms of the capacity to mentalise having a positive impact on social skills rather than vice-versa (Jenkins & Astington, 2000; Cutting & Dunn, 1999). Nevertheless, the fact that in this study the "at risk" group presented with deficits in social skills relative to the "low risk" group but no evidence of poorer mentalising ability suggests that the two areas of functioning may not be as closely linked as the literature suggests. In chapter 2 we tentatively hypothesised that the association could be transactional in nature, and that potentially the social skills deficits in the "at risk" group might lead to subsequent impairments in ToM a year later. This hypothesis has not been supported. Perhaps the intact ToM (in terms of the lack of relative deficit) of the "at risk" group at age 3 protected them from presenting with a continued or worsening deficit in social skills a year later, since at age 4 the "at risk" group were no longer functioning below the population average range. This would be consistent with the previous literature. Clearly this issue cannot be adequately addressed with the available data, and further follow-up assessments of this sample would be necessary to investigate the developmental association between social skills and theory of mind across a longer time scale.

The notion that an underlying "cognitive vulnerability" could predict a reduced capacity to cope with a negative environment and hence could lead to later emergence of conduct problems (Nigg & Huang-Pollock, 2003) might also be called into question given the above results. If we consider skills governed by the frontal area of the brain as those primarily affected by "cognitive vulnerability" and the capacity to mentalise (ToM) as a system served by this area of the brain, it might also be expected that a deficit in theory of mind competency would be evident before or at least alongside the emergence of conduct problems. The fact that this was not the case suggests that the data do not support the cognitive vulnerability hypothesis. However, it is possible that "cognitive vulnerability" is manifested in different ways early in development. As discussed in chapter 2, perhaps the observed deficits in verbal ability in the "at risk" group at time 1 were precursors to later impairments in mentalising ability which were always present but simply not detectable with the tasks used that early in development. The fact that there was still no significant difference between the "at risk" and the "low risk" groups at time 2 suggests that we should be cautious in accepting this interpretation until further follow-ups of the present sample confirm evidence of a deficit in the "at risk" group relative to the "low risk" group. Age 4 may still be too early for this effect to be clearly demonstrable given that the pre-school period is a key transitional stage in the development of ToM skills (see

Wellman, Cross & Watson, 2001), although at least one other study of pre-schoolers has reported a deficit in theory of mind amongst young hard-to-manage children (Hughes et al, 1998).

With regard to inhibitory control, there was also no significant difference between the two groups at age 4, suggesting that in the pre-school years verbal and non-verbal ability may be more important aspects of cognition to focus on as markers of or risk factors associated with conduct problems. This could be because no deficit in IC exists at this age, or because it is not demonstrable with the measures available to us in this study.

In summary, the group of children identified as "at risk" for conduct problems at age 3 continued to display significantly higher levels of conduct problems and hyperactivity at age 4 than the pre-identified "low risk" children. Despite evidence of some improvements in cognitive ability and social skills between the ages of 3 and 4, the "at risk" group still evidenced significantly poorer verbal ability, non-verbal ability and social skills than the "low risk" group at follow-up. The hypothesis that the "at risk" group would begin to display impairments in ToM and IC skills at age 4 relative to the "low risk" group was not supported.

4.4.2 Boys versus girls within the "at risk" group at age 4

Worthy of note is that at age 3, although comparable numbers of boys and girls were above the population 90th percentile for levels of conduct problems, the boys still presented with significantly higher levels of conduct problems than girls according to parents. However, since age-specific norms for boys and girls apply, the parent-rated conduct problems mean scores in fact equate to a score above the population 96th percentile for both boys and girls, even though the overall level was higher for boys. Teacher ratings placed boys in the 88th percentile and girls in the 95th percentile. Thus, in general, both "at risk" girls and "at risk" boys displayed high and comparable levels of conduct problems at age 4, according to the population norms.

At time 2 the magnitude of difference in the levels of parent-rated conduct problems was comparable to that seen at age 3 (effect size 0.74 at both time points), indicating that boys showed higher absolute levels of pathology, but that boys and girls scored at a similar level in relation to the population norms for boys and girls. Teachers continued to rate boys and girls comparably in terms of absolute levels of behaviour, placing girls in a higher percentile than boys with regard to population norms but both above the 80th percentile. However, for both boys and girls the levels of conduct problems decreased (time 1 mean parent-rated score above the population 94th percentile for boys and 91st percentile for girls, and time 1 mean teacher-rated score above the population 82nd percentile for boys and 93rd percentile for girls). Despite the downward trend at time 2 in both sexes, the level of pathology was still high. The pattern of findings was however somewhat different to that hypothesised. We expected boys to evidence greater levels of conduct problems, yet at both time points it seems that, if anything, the level of pathology in the "at risk" girls was higher, at least according to teacher ratings.

This was a surprising finding, given that previous research has attested to a similar level of conduct problems between girls and boys in the preschool years (e.g. Rose et al, 1989), and the overwhelming finding at least with older children has been consistently in the direction of higher levels of conduct problems in boys than girls (Moffitt et al, 2001). It was also the case that girls maintained this level of teacher-rated conduct problems relative to boys across the course of a year, perhaps supporting the hypothesis that early-onset conduct problems in girls may not be less likely to persist as some researchers have suggested (e.g. McCabe et al, 2004). It is possible that in particularly high-risk environments girls could in fact be equally, if not more likely, to engage in high levels of conduct problems. It remains to be seen, should this cohort be followed up in the future, whether girls would be likely to continue along this trajectory or whether in fact it is a transitory stage that the girls will outgrow. At this early stage at least, the data support the notion that Moffitt's (1993) "early-onset/persistent" developmental trajectory does apply to girls.

We hypothesised that in addition to higher levels of conduct problems at age 4, "at risk" boys would also continue to present with a significantly poorer risk factor profile than "at risk" girls. Specifically, we predicted relative impairments in theory of mind, non-verbal ability and levels of hyperactivity compared to "at risk" girls.

In the followed-up sample at time 1 there still emerged a trend towards lower levels of experimenter-rated hyperactivity in "at risk" girls relative to "at risk" boys, but the differences in ToM and non-verbal ability no longer reached significance. The pattern of scores on these measures, however, were consistently in the direction of higher functioning on the part of the girls. Nevertheless, in the followed-up sample at least it is less clear than it appeared from the data presented in chapter 2 whether the "at risk" girls at age 3 presented with a more favourable risk factor profile than boys.

Thus, the picture for "at risk" girls at time 1 did not appear as promising as it had done in the larger sample. However, at the time 2 follow-up, findings were fairly consistent with hypotheses and with the time 1 findings in the larger sample. Namely, non-verbal ability was two-thirds of a standard deviation higher in "at risk" girls than "at risk" boys, and whilst the boys were within the population average range, the effect size was a moderate 0.50, and the difference approached significance. Furthermore, when time 1 verbal ability was covaried for, the gender difference did reach significance, suggesting that the gender difference was not carried by differences in verbal ability between "at risk" boys and girls at age 3.

As discussed in chapter 2 when the same gender difference arose, this relatively high level of non-verbal cognitive ability in girls might be proposed as a protective factor against continued conduct problems later in development. It might explain why the early-onset/persistent trajectory (Moffitt, 1993) has been found to be less common amongst girls (McCabe et al, 2004). This could be via the heightened opportunities to benefit from intervention initiatives that may be afforded to girls but not boys if their ability to understand and implement them is high. They may also be protected by relative success at school in later years, although since boys were functioning in the average range this perhaps would not constitute a significant relative deficit in the boys.

It should be noted however that the gender difference did not remain significant when hyperactivity at time 1 was controlled for. This indicates that "at risk" boys' tendency towards higher levels of hyperactivity than "at risk" girls could be responsible for the observed gender difference in non-verbal ability. This could take the form of elevated levels of hyperactivity interfering with task completion for boys or indeed interfering with learning and acquisition of knowledge. Alternatively, the finding could reflect that boys are more likely to possess the "cognitive vulnerability" which has been proposed to underlie conduct problems (Rutter et al, 1999). Girls on the other and could be engaging in conduct problems for socially motivated reasons rather than as a result of a cognitive deficit. In either case, the prognosis for boys could be predicted to be worse than for girls, although perhaps a more significant non-verbal deficit, below the population average level, would be necessary to produce negative consequences for boys.

Further support for the notion that "at risk" boys may present with a relative cognitive impairment compared to "at risk" girls, albeit by virtue of their higher levels of hyperactivity, was found with regard to theory of mind performance at time 2. As predicted, and consistent with findings in the larger sample at time 1, "at risk" girls achieved a significantly higher pass rate on the Wellman composite of the theory of mind test battery than "at risk" boys. "At risk" girls' mean score was closer to 2 (1.62) whilst the boys' mean score was closer to 1 (1.17), indicating a greater tendency for girls to pass both tasks. The magnitude of difference was greater than at time 1 (effect size 0.66 compared to 0.53 at time 1), and the difference still approached significance when controlling for hyperactivity at time 1. However, this finding was not replicated with regard to the false belief composite, in which no significant gender differences emerged. The finding with regard to the Wellman composite might offer some tentative support for the notion of a stronger "cognitive vulnerability" (Nigg & Huang-Pollock, 2003; Rutter et al, 1999) in boys, although why this finding is not replicated in the false belief composite is not clear.

One further finding which appears to suggest a stronger cognitive deficit in "at risk" boys than "at risk" girls at time 2, and one which was not predicted, was the significant gender difference with regard to performance on the Day/Night task. Girls were significantly more likely to pass this task than boys, though not Luria's handgame. Hughes et al (1998) found IC deficits amongst their group of "hard to manage" preschoolers, whilst in the present study at age 3 this finding was not replicated. We proposed that this could be due to the underlying "cognitive vulnerability", which had been proposed to constitute deficits in IC (Nigg & Huang-Pollock, 2003), manifesting itself in other ways at a younger age. Thus, we proposed that the deficits in verbal ability which were evident within our "at risk" group represented an early form of this "cognitive vulnerability", and that when the children were older we may begin to see the expression of this vulnerability in terms of IC deficits. If the cognitive vulnerability hypothesis is in fact only applicable to boys, then it follows that only boys would begin to display this deficit at age 4.

However, a number of factors would first need to be explained before such a hypothesis could be accepted. Firstly, why would "at risk" boys and girls at age 3 be equally likely to display deficits in verbal ability if this was in fact an early expression of a cognitive vulnerability specific to boys? Secondly, why is the gender difference within the "at risk" group not found across both measures of IC at age 4? The fact that the gender difference with regard to the IC composite overall no longer approached significance when controlling for time 1 hyperactivity could suggest that in fact the relative IC deficit in boys could relate to hyperactivity, consistent with Barkley's (1997) inhibition theory of hyperactivity. Thus, if boys do possess a stronger cognitive vulnerability, perhaps this relates specifically to their hyperactivity, and does not indicate differential mechanisms underlying the conduct problems shown by these "at risk" boys and girls. Of course, even this theory suggests that boys may have a poorer prognosis for the future than girls, by virtue of their co-morbid hyperactivity and the host of other deficits that go alongside the behaviour. Having hyperactivity, poor mentalising ability and poor inhibition, alongside conduct problems, even if the difficulties did not cause or stem from the conduct problems directly, could present boys with a greater number of obstacles against desisting from antisocial behaviour in the future.

Interestingly, despite the above theoretical debate surrounding elevated hyperactivity levels in "at risk" boys, and contrary to the hypothesis, at time 2 "at risk" boys did not in fact display significantly higher levels of hyperactivity than "at risk" girls. The pattern of results for all raters was in the direction of higher levels of hyperactivity in boys relative to girls, and the covariate effects in the analyses above suggest that the differences may have been sufficiently large as to be associated with differences in cognition for girls and boys. Nevertheless, overall, levels of hyperactivity were not significantly higher in "at risk" boys than "at risk" girls. Might the findings suggest therefore that levels of hyperactivity in "at risk" boys were not significantly higher than "at risk" girls, but were significantly more likely to be associated with cognitive impairment? Despite a pattern of results in the hypothesised direction, therefore, we cannot conclude that "at risk" boys were significantly more likely than "at risk" girls to display high levels of hyperactivity at age 4.

Several points are worth noting with regard to the findings relating to gender differences within this "at risk" group of children. Firstly, the differences reported are not as strong in magnitude as those reported in comparisons between the "at risk" and "low risk" groups, and therefore we should be more cautious in our interpretation of the findings. Nevertheless, the fact that the sample size for these analyses was half that of the "at risk" versus "low risk" analyses could have in part contributed to the more modest differences reported between the groups. Another interesting point is that across both the age 3 and age 4 analyses, the gender differences reported between the "at risk" boys and girls have been concerned with different areas of functioning to those reported between the "at risk" and "low risk" and "situational" and "pervasive" groups. The latter comparisons have revealed group differences across a common set of risk factors, with verbal ability, social skills and hyperactivity as the main areas of difference. The gender difference analyses on the other hand, though consistent with the previous analyses with regard to the hyperactivity discrepancy, have tended to report differences between boys and girls on other aspects of functioning. Non-verbal ability, theory of mind and inhibitory control, rather than verbal ability and social skills, emerged as the important differences.

This could suggest that there is something qualitatively different about the presentation of boys and girls with early conduct problems that is more than just a more severe profile of impairment for boys. If it were the case that boys and girls presented with the same risk factors for conduct problems, as proposed by Moffitt et al (2001), and that boys were merely at the more extreme end of the continuum with regard to the risk factors, then we might expect boys to present with poorer social skills and poorer verbal ability than "at risk" girls, yet our findings do not support this notion. The findings of the present chapter also implicate the role of hyperactivity in understanding the gender differences in conduct problems, in that conduct problems for boys could be more likely to be associated with hyperactivity, and the cognitive impairments that go alongside hyperactivity. It could be that this is why boys are more likely to continue along the "early-onset/persistent" (Moffitt, 1993) developmental trajectory than girls, rather than girls being less predisposed to antisocial behaviour in the first place.

In sum, "at risk" girls showed some evidence of slightly higher scores than "at risk" boys on aspects of cognitive ability including non-verbal IQ, theory of mind and inhibitory control. Although the hypothesis that "at risk" boys would present with significantly elevated levels of hyperactivity than "at risk" girls was not supported, the results were in the hypothesised direction and small sample sizes may have contributed to the lack of significant difference. There was also some suggestion that for the "at risk" boys, hyperactivity may have been more strongly associated with cognition than it was for the "at risk" girls, even if the levels of hyperactivity between boys and girls were in fact not significantly different.

4.4.3 The "pervasive" group at age 4

It was not possible to statistically analyse the data for such a small group of children, but the case-study profiles of the children at age 4 are still worthy of comment, since at age 3 these children presented with significant risk for continued problems. Our question therefore was whether the pattern of results suggested that they could still be considered at high risk at age 4.

In general, the case studies suggested that overall the group were still functioning below the level of the sample as a whole, in terms of higher levels of conduct problems and hyperactivity, poorer cognitive ability and poorer social skills. One or two children demonstrated above average cognitive ability, but even these children did not present with low risk across the board of risk factors. Case number 79, for example, a girl, scored 129 on the non-verbal IQ measure, above the population 97th percentile, and was in the average range on the verbal ability measure. However, she scored 5 on the teacher SDQ conduct problems sub-scale, indicative of levels of conduct problems above 99% of the population. No data were available for this child with regard to parent-rated conduct problems at age 4, and thus we cannot determine whether her conduct problems were still pervasive. This example illustrates that whilst not all children presented with deficits across all risk factors, this did not necessarily protect them against continued conduct problems.

A small number of children constitute particularly worrying profiles. Case number 150 for example scored the highest score on teacher-rated conduct problems, a score of 10, above 100% of the population. Also of concern was the fact that her teacher-rated hyperactivity score was equally high (again, scoring 10/10, in the 100th percentile), her experimenter-rated hyperactivity score was also the highest at 26 out of 37, and her non-verbal IQ score was in the learning disability range (60). Her verbal ability was also below the population average range (80). Case number 162 (a boy) also presented with significant problems. He scored 4/10 on the parent SDQ conduct problems sub-scale (above the population 92nd percentile), and 6/10 on the teacher SDQ conduct problems sub-scale (above the population 98th percentile), thus still displaying pervasive conduct problems. Furthermore, his hyperactivity levels were amongst the highest in the group (5/10 for both parent and teacher ratings, above the population 70th and 73rd percentiles respectively). His non-verbal IQ score of 70 was also in the learning disability range.

Clearly, then, there are at least one or two children of particularly high risk in the pervasive group at time 2, and even those with above average cognitive functioning did not all demonstrate complete abstinence from conduct problems. In general, the case studies seem to suggest that at least a handful of the children identified with pervasive risk at age 3 still present with significant cause for concern at age 4.

4.4.4 "Desisters" and "Persisters"

Richman et al (1982) reported that 63% of their "behaviour problem" group at age 3 continued to fall above the threshold for behaviour problems a year later. In the present sample, a slightly smaller 48% persisted according to our criteria (continuing to fall above the population 90th percentile on one of the SDQ "conduct problems" sub-scales). This difference could be due to our differing measures of behavioural deviance. For Richman et al's sample, the children could fall above the cut-off if they displayed high levels of hyperactivity or conduct problems, whereas for our sample they had to be above the cut-off specifically for conduct problems. Perhaps if we had included other measures of behavioural pathology we would have identified a greater number of persisters.

One point worth noting, and one which might offer an alternative explanation for the smaller proportion of "persisters" in the present sample compared with Richman et al's (1982) sample, is that the norms used to categorise our "at risk" group at age 3 were based on a sample of 5 to 10 year olds (Meltzer et al, 2000). Thus, perhaps the reason for the higher proportion of children falling above the population 90th percentile at age 3 was that the children were younger than the normative sample and thus more likely to display behaviours deemed age-inappropriate for children at least 2 years their senior. This point was discussed in detail in chapter 2. By the same reasoning, one can deduce that a year later the children would begin to look much more like the 5 year old normative sample, being closer to their age, and thus in line with this fewer children would be expected to fall above the population 90th percentile. Were 3-year-old norms available it may have been the case that the 90th percentile cut-off point on the conduct problems scale of the SDQ would have been considerably higher than the 90th percentile for the 5-10 year olds. In other words, the defining criteria for our "at risk" group could have produced a high number of "false positives" who were in fact behaving age-appropriately, and hence it should not be surprising that slightly more than expected (based on previous findings such as Richman et al's (1982) study) desisted from the behaviour a year later. This conclusion is possible, yet the fact that the "at risk" children as a group were having significant problems across various other areas of functioning compared with their "low risk" peers at age 3 suggests that their behaviour was unlikely to have been "age-appropriate" and that there were clear reasons to expect that they were "at risk" for future problems.

It was hypothesised that girls would be under-represented relative to boys in the "persistent" group at time 2. This was based largely on Richman et al's (1982) findings that behaviour problems at age 3 were more predictive of continued significant behaviour problems for boys than they were for girls. Furthermore, despite the fact that McCabe et al (2004) found evidence for the applicability of the "early-onset/persistent" developmental trajectory (Moffitt, 1993) to girls, they reported that this trajectory was less common in girls than it was in boys. Thus, it was anticipated that amongst children identified "at risk" at age 3, a greater number of "false positives" would be evident amongst the girls.

Nevertheless, it emerged that in fact the "at risk" children were equally likely to be "persisters" as they were to be "desisters" at age 4, and moreover that approximately half of the girls and half of the boys fell into each category, such that gender did not appear to influence the likelihood that children would continue to display significant conduct problems a year later. It may be the case that longer-term follow-up would be necessary to demonstrate the gender differences in the developmental trajectories following early-onset conduct problems, and that more stringent definitions of "persisting" and "desisting" would also produce results more consistent with previous research. However, due to limited numbers of children moving from the "at risk" to the "low risk" categories and vice-versa between time 1 and time 2, such a stringent approach was not possible here. Consequently, children referred to as "desisters" may not have received a dramatically different score on the SDQ at age 4, but merely fallen just below the arbitrary cut-off point at time 2.

To move just one category from time 1 to time 2, for example from the "at risk" to the "middle" group, might in fact only represent a 1-point shift by one rater in a child's SDQ score. Therefore these labels do not necessarily constitute a significantly large behavioural shift. The aim was merely to attempt to identify some ways in which the two groups might be distinguishable from one another and therefore how one might predict the likelihood that a given person with early conduct problems would continue to present with significant problems a year later. Unless carefully defined clinical criteria are used to identify "persisters" and "desisters" the categories can only serve as approximate markers. Given that the children in this study are in community settings and not old enough to receive formal diagnoses of CD, the true number of persisters and desisters cannot be ascertained until the children are significantly older.

It is equally plausible however that our contrary findings reflect a different developmental trajectory in children from "at risk" communities in particularly deprived environments such as the population from which the current sample was drawn. Thus, perhaps under particularly adverse circumstances boys and girls are equally likely to develop early-onset antisocial behaviour and to continue to display such behaviour. Indeed, the fact that a third of the children in the present sample presented with conduct problems above the population 90th percentile according to Meltzer et al's (2000) normative data suggests that the level of conduct problems was unusually high in this sample. Indeed, other studies of high-risk populations have reported a higher prevalence of early-onset/persistent antisocial or aggressive behaviour in girls than has been traditionally reported in other samples (e.g. Brennan, Hall, Bor, Najman & Williams, 2003). However, if it is the case that the present sample were particularly "at risk" relative to samples in previously reported studies, it is surprising that overall fewer of the "at risk" children than expected and indeed fewer than reported in similar studies, showed continued high levels of conduct problems at age 4.

Lahey et al (2002) reported that a number of risk factors predicted persistence, albeit referring to clinical levels of CD within a sample aged 7 and above at baseline. Having fewer CD and ADHD symptoms at the outset, and being from a disadvantaged family were risk factors for persisting conduct problems. Whilst Lahey et al (2002) did not measure all of the same risk factors as included in the present study, we predicted that "persisters" would have shown a poorer risk factor profile at age 3, and that hyperactivity, conduct problems and verbal ability would be significant risk factors. Moreover, it was also predicted that the persisters would begin to present with a poorer risk factor profile than desisters at age 4, since their continued conduct problems may have begun to adversely impact upon other areas of functioning.

Contrary to predictions, there were no significant differences in the risk factor profiles of persisters and desisters at age 3. However, the pattern of results was consistent with persisters displaying higher levels of conduct problems and hyperactivity at age 3 (according to teachers), in line with Lahey et al's (2002) reported findings. The mean teacher-rated conduct problems score for the desisters at time 1 would place the girls, but not the boys, above the population 90th percentile. The mean score for the persisters at time 1 however would place all children above the population 90th percentile, and girls above the 97th percentile. The effect size of 0.51 for this difference was also moderate in size, even though the difference did not reach significance.

Furthermore, a moderate effect size (0.46) was also evident with regard to the extent to which persisters' levels of time 1 teacher-rated hyperactivity exceeded the desisters', and this difference in fact approached significance when time 1 verbal and non-verbal ability were partialled out of the equation. The difference equated to a score above the 54th and 76th percentile for boys and girls respectively in the desisters, and above the 67th and 86th percentiles in the persisters. Clearly the level of pathology in the persisters was not as high with regard to hyperactivity as for conduct problems, yet there was still evidence that it was higher in relation to the desisters. This finding was consistent with our hypothesis, but was only a trend and did not reach statistical significance.

At time 2 there were clear differences in levels of both parent and teacher rated conduct problems, with persisters displaying significantly higher levels than desisters across both informants. In terms of the levels of conduct problems in the "persisters" at time 2, their level of pathology was above the population 90th percentile for both boys and girls and for both parent and teacher ratings, reaching as high as the 98th percentile for parent-rated conduct problems in female persisters. Conduct problems therefore showed slightly elevated levels compared with time 1 scores in the persisters at time 2, suggesting their conduct problems were not only persisting but worsening with time.

Levels of teacher rated hyperactivity remained high in the persisters relative to the desisters, and at similar levels to those seen at time 1. The magnitude of difference increased for parent-rated hyperactivity, with the desisters' mean scores decreasing from age 3 to 4 whereas levels of parent-rated hyperactivity increased for the persisters. By time 2 the mean score for desisters placed them above the population 45th percentile for boys and 60th percentile for girls. Persisters on the other hand were above the 60th and 74th percentiles respectively. Thus, the magnitude of difference between the groups increased at time 2, and once time 1 verbal and non-verbal ability were controlled for, parent-rated hyperactivity in the persistent group was significantly higher than in the desisting group, and a trend in the same direction emerged with regard to teacher-rated hyperactivity. The pattern of results for experimenter-rated hyperactivity was in the same direction but not approaching significance.

By age 4, then, there already seems to be a clear indication that the prognosis for the persisters could be particularly poor. They presented with pervasive and worsening conduct problems, and co-morbid hyperactivity, which has been consistently reported to be predictive of poor outcome (Lynam, 1996; Babinski et al, 1999). Nevertheless, their functioning according to other areas of cognition and social behaviour at age 4 was not consistently poorer as one might predict.

As noted for the whole of the "low risk" and "at risk" sample at follow-up, the performance of both the persisters and the desisters with regard to social skills improved between the ages of 3 and 4. This was particularly notable with regard to teacher-rated social skills, which for both groups improved from the low end of the population average range at age 3 to around a standard deviation above, in the mid-average range at age 4. There were no significant differences between the persisters and desisters at age 4, and all were functioning at age-appropriate levels socially. No evidence was found therefore to suggest that the social functioning of the persisters had been adversely affected by their continuing conduct problems, despite the reported findings in the literature that children with conduct problems and hyperactivity (as the persisters appeared to be showing) are likely to experience peer rejection (Vaghn et al, 1992; Wood et al, 2002), which one might expect would be detrimental to the advancement of their social skills. It is possible however that social skills are likely to be influenced by environment and experience, and hence perhaps being aggressive and anti-social over a prolonged period of time would result in a lack of opportunities to learn and develop more complex social skills. Thus, even if children posses basic, age-appropriate social skills at pre-school, if their behaviour continues to be anti-social further into development they will begin to experience peer rejection and consequently fail to keep up with their peers in terms of social competency (Coie, Coppetelli & Dodge, 1982).

In essence, therefore, it could be that the children are too young for their behaviour to have had a negative impact on their social skills, although this would contradict previous studies which have found evidence of social skills deficits in children as young as 3 years old, which predict engagement in adult criminality (Stevenson & Goodman, 2001). Thus the consensus in the literature seems to be that children with early conduct problems would be expected to show some degree of impairment in social competency and absence of social support, which would be expected to predict and precede persistent conduct problems (Sampson & Laub, 1994). Hence the results of the present study are not consistent with these established findings.

Nevertheless, there is some evidence that being aggressive does not have to mean that children are rejected by their peer group or that social skills are lacking, although such findings are scarce in comparison to the vast literature base on social skills deficits in children with conduct problems.

Farmer, Estell, Bishop, O'Neal and Cairns (2003) for example, reported that there were 2 distinct types of aggressive youth, those who were considered unpopular and had few friends, and those who were popular and of high social status. The popular aggressive youths tended to be rated by peers as being socially skilled and by teachers as being involved in extra-curricular social activities. This notion fits with Sutton et al's (1999) portrayal of the "ringleader" bully, presenting with good social skills and advanced theory of mind skills which are deliberately utilised to manipulate and influence the peer group into joining in with antisocial behaviour and bullying. Some aggressive children, according to these theories, do present with deficits in social and cognitive functioning, and they may be the children who "join in" with delinquent peer groups and are involved in bullying, whereas other children present with a more "psychopathic" profile in which aggressive behaviour is planned and pre-meditated with full appreciation of its impact on the feelings of others and with the available social skills to behave pro-socially if they were so inclined.

The term "psychopathy" refers to a group of individuals lacking guilt and empathy and showing poverty of emotions, alongside a grandiose sense of self-importance and an interpersonal style characterised by the callous manipulation of others (Frick, 2001). Such a concept relates to the distinction between "pro-active" and "reactive" aggression (Dodge & Coie, 1987). Reactive aggression has been proposed to result from deficits in social information processing skills which result in an individual misinterpreting the intentions of others and thus reacting in an aggressive manner accordingly (Dodge & Coie, 1987), whilst pro-active aggression is pre-meditated and not triggered by emotional factors, and is characteristic of psychopathic individuals (Frick, 2001). Without the available measures of "callous/ unemotional" traits thought to more accurately characterise psychopathic tendencies (Barry et al, 2000), and with a focus on children too young to be labelled "psychopathic", one can only speculate upon the likelihood that the profile of our "persisters" might represent behaviour consistent with psychopathic tendencies. Lynam (1996) has argued that children presenting with a profile of conduct problems and hyperactivity are similar in presentation (behaviourally and neuropsychologically) to adults with psychopathic personality, and other researchers have suggested that psychopathic individuals are likely to belong to a sub-type of the "early-onset/ persistent" group of antisocial individuals (Moffitt, Caspi, Dickson, Silva & Stanton, 1996; Frick, 2001), but to be less likely to exhibit deficits in social and intellectual functioning (Hare, Hart & Harper, 1991). Many of these descriptions apply to the persisters in the present sample. To be consistent with such a theory, we would also expect our persisters to have normal intellectual functioning (Hare et al, 1991), advanced or at least not deficient theory of mind skills (Sutton et al, 1999), and deficits in executive functions such as our measure of IC which have been shown to be impaired in adult psychopaths and "fledgling psychopaths" or young children showing psychopathic tendencies (Lynam, 1996).

Non-verbal IQ scores were indeed in the normal range at both age 3 and age 4 in the "persistent conduct" group, and did not differ significantly from the desisters at either time point. Verbal functioning was also in the average range at both time points and slightly (but not significantly) higher than that of the desisters at both age 3 and age 4. Theory of mind competency was higher in the persistent group compared with the desisting group at time 1 but not significantly so, but at time 2 the persisters were performing significantly better than the desisters and showed greater advancement in task performance between the ages of 3 and 4 than did the desisters. Having an advanced understanding of others' minds yet presenting with a profile of antisocial behaviour is consistent with Sutton et al's (1999) conjecture that a sub-type of antisocial individual may not be characterised by social information processing deficits. This is suggestive of "proactive" or pre-meditated antisocial behaviour as opposed to that which is brought about by poor social processing (Dodge & Coie, 1987).

Nevertheless, one should exert extreme caution in interpreting these findings. The children in this study are still pre-schoolers and thus could not be deemed "fledgling psychopaths" at such a young age. Furthermore, their antisocial behaviour has only persisted up to age 4 at this point, which does not constitute long-term or enduring antisocial behaviour by any definition. In addition, many researchers have argued that without evidence of "callous/ unemotional" traits, one cannot accurately define psychopathic tendencies (Barry et al, 1999; Frick, 2001) and others have criticised the "conduct/ hyperactivity" theory proposed by Lynam (1996) for being over-inclusive in its description of "fledgling psychopaths" and have reported that there is a lack of sufficient evidence upon which to base the theory that the hyperactivity-conduct problems profile is distinguishable from other behavioural profiles in terms of the likelihood that psychopathic traits are present (Abramowitz, Kosson & Seidenberg, 2004). Finally, Lynam (1996) proposed that "fledgling psychopaths" who presented with conduct problems and hyperactivity would also demonstrate concurrent deficits in executive functions, in particular response inhibition or inhibitory control. However, there was no evidence in the present study that persisters were deficient relative to desisters at either time point in terms of the capacity to inhibit responses as measured by the IC composite.

In summary, no significant differences at time 1 were apparent between the persisters and desisters, although there was some evidence of elevated levels of conduct problems and hyperactivity in the persisters. At time 2 there were clear differences between persisters and desisters in terms of their behavioural profile with regard to conduct problems and hyperactivity, with significantly higher levels in the persisters. However, despite this there was no evidence that the persisters had impairments in social or intellectual functioning, and in fact presented with theory of mind skills which were significantly advanced in comparison with the desisters. The possibility that this profile could reflect a construct similar to a psychopathic tendency was tentatively considered.

4.5 Chapter summary

- "At risk" children continued to display significantly higher levels of conduct problems than "low risk" children at age 4. The "at risk" group still evidenced significantly poorer verbal ability and social skills than the "low risk" group as well as elevated levels of hyperactivity. Further, they presented with significantly lower non-verbal IQs than the "low risk" group. However, cognitive and social functioning in the "at risk" group was now within the population average range.
- At least a handful of the children identified with pervasive risk at age 3 still appeared to present with significant cause for concern at age 4.
- "At risk" girls showed some evidence of slightly higher scores than "at risk" boys on non-verbal IQ, theory of mind and inhibitory control measures. "At risk" boys did not show significantly elevated levels of hyperactivity than "at risk" girls, contrary to the hypothesis, though the pattern of results was in the hypothesised direction. Hyperactivity seemed to be more strongly negatively associated with cognitive ability in boys than girls.
- Approximately half of the "at risk" group were "desisters" at age 4 whilst half were "persisters". "At risk" boys and girls were equally represented within the "persisters".
- No significant differences at time 1 emerged between the persisters and desisters, although there was some evidence of elevated levels of conduct problems and hyperactivity in the persisters. At time 2 persisters showed significantly higher levels of conduct problems and hyperactivity. However, despite this there was no evidence that the persisters had impairments in social or intellectual functioning, and in fact presented with theory of mind skills which were significantly advanced in comparison with the desisters.

5

Associations between behaviour and cognition at age 4: Cross-sectional dimensional analyses

5.1 Chapter aims and hypotheses

In chapter 3, we examined the associations between 2 separate aspects of externalising behaviour (conduct problems and hyperactivity) and 4 cognitive processes (non-verbal IQ, verbal ability, theory of mind and inhibitory control), across the whole sample at 3 years old. We reported that hyperactivity was negatively associated with a more pervasive range of cognitive processes than conduct problems. The predominant cognitive function negatively associated with conduct problems was verbal ability, and with regard to parent-rated conduct problems this association was independent of hyperactivity. Hyperactivity, on the other hand, was significantly negatively associated with verbal ability, non-verbal ability, ToM and IC, independently of conduct problems. However, this extensive range of associations was only applicable to hyperactivity in the nursery context. Parent-rated hyperactivity was specifically and independently associated with non-verbal ability.

The finding that verbal ability showed a unique and independent association with conduct problems replicated previous findings with regard to clinical or severe levels of antisocial behaviour (Moffitt, 1990). It was also consistent with our categorical analyses in chapter 2, in which the "at risk" group displayed significantly poorer verbal ability (but not non-verbal ability, ToM or IC) than the "low risk" group. This suggested that a specific verbal deficit could characterise conduct problems and that, moreover, this association could be applied to extreme or severe levels of conduct problems and to more normative variations in levels of conduct problems. Thus, the association may not be specific to clinical disorders such as conduct disorder or ODD.

The finding that hyperactivity seemed to be negatively associated with a number of cognitive processes suggested one of two things. It could offer support for the conjecture that a genetic or cognitive vulnerability underlies hyperactivity and predisposes hyperactive children to a more direct and pervasive set of cognitive impairments than those associated with conduct problems (Nigg & Huang-Pollock, 2003; Rutter et al, 1999). Finding support for this theory across a non-clinical community sample suggested that this theory might not be limited to clinical levels of behaviour sufficient to meet clinical criteria for ADHD but might apply to the wider variations in levels of hyperactivity seen across the population. On the other hand the finding could indicate that being hyperactive interferes with a wider range of cognitive functions and therefore leads to a more pervasive set of cognitive impairments than conduct problems. Again, this would suggest that this applies to both ADHD and lower levels of hyperactivity seen in non-clinical populations.

The present chapter aimed to investigate the same set of associations across the sample a year later, at age 4. Since Plomin et al (2002) reported that associations between behaviour and cognition increased incrementally with age between the ages of 2, 3 and 4-years-old, we expected that associations between the same aspects of behaviour and cognition as those found at age 3, would, if anything, be strengthened at age 4. We also aimed to examine the extent to which the categorical associations between cognition and "risk" for conduct problems (chapter 4) would apply to individual differences in levels of cognition and conduct problems (chapter 5). In line with predictions and findings at age 3 (chapter 2 versus chapter 3), we proposed that findings between chapters 4 and 5 would be comparable.

5.1.1 Summary of chapter 5 aims and hypotheses

- Conduct problems will be significantly negatively associated with verbal ability. This association will remain significant when controlling for hyperactivity.
- Any other significant associations between conduct problems and cognition (e.g. non-verbal IQ, theory of mind or inhibitory control) will no longer remain significant when controlling for hyperactivity.
- Teacher and experimenter-rated hyperactivity will be significantly negatively associated with verbal ability, non-verbal IQ, theory of mind and inhibitory control. These associations will remain significant when controlling for conduct problems.
- Parent-rated hyperactivity will be significantly negatively associated with non-verbal IQ independently of conduct problems.
- To examine differences between the categorical (chapter 4) and dimensional (chapter 5) findings at age 4. Results are expected to be comparable.

5.2 Method

5.2.1 Design and participants

This chapter is concerned with the followed-up sample of 156 children (73 boys and 83 girls) described in detail in chapter 4. The follow-up procedure for obtaining data at time 2 on these children is also detailed in chapter 4.

5.2.2 Measures

All measures are as reported in section 2.2.5 of chapter 2.

5.2.3 Analyses

All analyses follow the same procedure and order as detailed in section 3.2.3 of chapter 3.

5.3 Results

5.3.1 A note about the followed-up versus not followed-up samples

In chapter 4, we presented analyses for the categorical data at time 2 alongside the comparable time 1 data in the followed-up sample at time 1. This method was chosen in place of comparing follow-up data with the original time 1 data presented in chapter 2 because the originally reported data included children not in the follow-up analyses.

The same issue applies here in comparing chapter 5 data in the present chapter with data presented in chapter 3, which included children for whom follow-up data were not available. However, the general pattern of results for the time 1 analyses in the followed-up sample was largely representative of the data presented in chapter 3, with the exception of a handful of weak significant effects in chapter 3 falling below significance in the followed-up sample, or effects just missing significance in chapter 3 now showing weak significant effects, despite similar r or R^2 values denoting similar magnitude of effects. These few slight differences between the time 1 results based on the larger sample and those based on the followed-up sample are listed in appendix L. These differences notwithstanding, excluding the children for whom follow-up data were not obtained from the time 1 analyses did not significantly alter the pattern of results reported in chapter 3. For this reason, there will not follow a separate section referring to the time 1 data in the followed-up sample in each phase of the results section.

5.3.2 Associations between conduct problems and hyperactivity

Table 5.1 shows the Pearson's correlations between parent and teacher-rated conduct problems at time 2 and parent, teacher and experimenter-rated hyperactivity at time 2. All ratings were significantly positively associated and weak to moderate in magnitude, with r ranging from .22 to .55, indicating that high levels of hyperactivity were associated with high levels of conduct problems, regardless of the rater. The strongest associations were those completed by the same rater or in the same setting. For example, teacher-rated hyperactivity and teacher-rated conduct problems were moderately correlated ($r=.55$, $p<0.001$), with 30% of variance in common, whereas parent-rated hyperactivity and teacher-rated conduct problems, whilst still significantly associated, were weakly correlated ($r=.32$, $p<0.01$), with only 10% of variance in common.

Table 5.1: Pearson's correlations between conduct problems and hyperactivity

Measures	Parent hyperactivity	Teacher hyperactivity	Experimenter hyperactivity
Parent conduct	.44*** (N=108)	.27* (N=73)	.22* (N=104)
Teacher conduct	.32** (N=73)	.55*** (N=107)	.44*** (N=103)

*p<0.05, **p<0.01; ***p<0.001

5.3.3 Associations between conduct problems, hyperactivity, and non-verbal & verbal cognitive ability

Aims and hypotheses: *Conduct problems are proposed to be significantly negatively associated with verbal ability, independently of hyperactivity. Teacher and experimenter-rated hyperactivity are hypothesised to be significantly negatively associated with both non-verbal IQ and verbal ability independently of conduct problems, whilst parent-rated conduct problems are expected to be significantly negatively associated with non-verbal IQ independently of conduct problems.*

Table 5.2 reveals that parent- and teacher-rated conduct problems showed no significant negative associations with verbal ability, contrary to the hypothesis (parent-rated: $r = -.17$, n.s; teacher-rated: $r= -.16$, n.s.), whilst teacher-rated conduct problems were significantly negatively associated with non-verbal IQ ($r= -.32$, $p<0.001$). This indicates that whilst weak in magnitude, higher levels of teacher-rated conduct problems were associated with having a lower non-verbal IQ, with these two variables sharing 10% of variance.

All measures of hyperactivity were significantly negatively associated with both verbal ability and non-verbal IQ, and whilst weaker than the associations for teacher and experimenter-rated hyperactivity, parent-rated hyperactivity was significantly negatively associated with non-verbal IQ (r= -.29, p<0.01) and verbal ability (r= -.24, p<0.05). These were weak associations, with only 6 – 8% of variance in common, yet the findings indicate that high levels of hyperactivity, regardless of the rater, is associated with correspondingly poor verbal and non-verbal cognitive ability. Associations between teacher and experimenter ratings of hyperactivity and cognitive ability were weak to moderate with regard to non-verbal ability (teacher-rated: r=-.55, p<0.001; experimenter-rated: r = -.43, p<0.001), corresponding to 30% of variance in common between teacher-rated hyperactivity and non-verbal IQ, and 18% of variance in common between experimenter-rated hyperactivity and non-verbal IQ. Weak but still significant negative associations were found with regard to verbal ability (teacher-rated: r = -.34, p<0.001; experimenter-rated: r = -.34, p<0.001), indicating that teacher and experimenter rated hyperactivity shared 12% of common variance with verbal ability.

Table 5.2: Pearson's correlations between conduct problems, hyperactivity, non-verbal IQ and verbal ability

Measure	Non-verbal IQ	Verbal ability
Parent-rated conduct problems	-.13 N=104	-.17 N=101
Teacher-rated conduct problems	-.32*** N=103	-.16 N=101
Parent-rated hyperactivity	-.29** N=104	-.24* N=101
Teacher-rated hyperactivity	-.55*** N=148	-.34*** N=144
Experimenter-rated hyperactivity	-.43*** N=148	-.34*** N=144

*p<0.05; **p<0.01; ***p<0.001

To further analyse the independent contribution of verbal ability versus non-verbal IQ to the variance in conduct problems and hyperactivity, 2 sets of regression analyses were calculated (see tables 5.3 and 5.4) in which verbal and non-verbal ability were entered at different steps to determine the extent to which any associations were independent of the other aspect of cognition. In table 5.3, only teacher-rated conduct problems were entered as a dependent variable, since no significant associations emerged between parent-rated conduct problems and either aspect of cognition. It emerged that, when entered at step 2, non-verbal ability (but not verbal ability) still contributed a unique and significant 33.5% of the variance to teacher-rated conduct problems (R-squared change = 0.08, F change (2, 98) = 8.61, Beta = -.34, p<0.01). Thus, over and above the variance explained by verbal ability, non-verbal ability still accounted for a significant proportion of the variance in teacher-rated conduct problems. Verbal ability, by contrast, and contrary to the hypothesis, was not a significant independent contributor of conduct problems over and above non-verbal IQ.

Table 5.3: Proportion of variance in teacher-rated conduct problems explained by non-verbal IQ and verbal ability (β, R^2 change)

	Teacher-rated conduct problems	
	β	R^2 change
Step1:		
Non-verbal IQ	-.322***	.103***
Step 2:		
Verbal ability	.025	.000
Step1:		
Verbal ability	-.158	.025
Step 2:		
Non-verbal IQ	-.335**	.079**

*p<0.05; **p<0.01; ***p<0.001

Table 5.4 details the regression equations for parent, teacher and experimenter-rated hyperactivity, and reveals that for all ratings verbal ability only accounted for a further 0.9, 0.7 and 1.6% of the variance in parent, teacher and experimenter-rated hyperactivity respectively, after taking account of the variance explained by non-verbal ability. Non-verbal ability on the other hand was a significant independent predictor of all ratings of hyperactivity: Parent-rated hyperactivity: step 1 (verbal ability): R-squared = 0.06, F (1, 99) = 5.95, Beta = -.24, p<0.05; step 2 (verbal ability, non-verbal IQ): R-squared change = 0.04, F change (2, 98) = 4.13, Beta = -.23, p<0.05. Teacher-rated hyperactivity: step 1 (verbal ability): R-squared = 0.14, F (1, 99) = 15.50, Beta = -.37, p<0.001; step 2 (verbal ability, non-verbal IQ): R-squared change = 0.17, F change (2, 98) = 21.48, Beta = -.49, p<0.001. Experimenter-rated hyperactivity: step 1 (verbal ability): R-squared = 0.12, F (1, 142) = 19.08, Beta = -.34, p<0.001; step 2 (verbal ability, non-verbal IQ): R-squared change = 0.09, Beta = -.35, p<0.001.

This indicates that 3.8% of the variance in parent-rated hyperactivity, 16.9% of the variance in teacher-rated hyperactivity, and 8.6% of the variance in experimenter-rated hyperactivity, was accounted for by non-verbal IQ, independently of variance explained by verbal ability. Verbal ability, contrary to the hypothesis, did not independently predict any rating of hyperactivity at time 2.

Table 5.4: Proportion of variance in hyperactivity explained by non-verbal IQ and verbal ability (β, R^2 change)

	Parent hyperactivity		Teacher hyperactivity		Exptr hyperactivity	
	β	R^2 change	β	R^2 change	β	R^2 change
Step1:						
Non-verbal IQ	-.294**	.086**	-.546***	.298***	-.434***	.188***
Step 2:						
Verbal ability	-.110	.009	-.099	.007	-.152	.016
Step1:						
Verbal ability	-.238*	.057*	-.368***	.135***	-.344***	.118***
Step 2:						
Non-verbal IQ	-.233*	.038*	-.492***	.169***	-.350***	.086***

*p<0.05; **p<0.01; ***p<0.001

Tables 5.5 and 5.6 present the data pertaining to the extent to which cognition predicted conduct problems independently of hyperactivity, and hyperactivity independently of conduct problems. Table 5.5 reveals that non-verbal IQ no longer contributed unique variance to teacher-rated conduct problems (0%) once variance explained by hyperactivity was taken into account (step 1 (parent-rated hyperactivity, teacher-rated hyperactivity, experimenter-rated hyperactivity): R-squared = 0.32, F (3, 69) = 10.97, Beta = 0.07, 0.44, 0.14, p<0.001; step 2 (parent-rated hyperactivity, teacher-rated hyperactivity, experimenter-rated hyperactivity, non-verbal IQ): R-squared change = 0.00, F change (4, 68) = 0.00, Beta = -.01, n.s.). In contrast, non-verbal IQ continued to predict a unique 4% of variance in parent-rated hyperactivity (though this only approached statistical significance), 15% of variance in teacher-rated hyperactivity, and 9.6% of variance in experimenter-rated hyperactivity, over and above that accounted for by conduct problems (table 5.6), as the following statistics illustrate: Parent-rated hyperactivity: step 1 (parent-rated conduct problems, teacher-rated conduct problems): R-squared = 0.22, F (2, 10) = 9.91, Beta = .37, .18, p<0.001; step 2 (parent-rated conduct problems, teacher-rated conduct problems, non-verbal IQ): R-squared change = 0.04, F change (3, 69) = 3.69, Beta = -.21, p=0.059. Teacher-rated hyperactivity: step 1: R-squared = 0.31, F (2, 70) = 15.84, Beta = 0.07, 0.53, p<0.001; step 2: R-squared change = 0.15, F change (3, 69) = 19.27, Beta = -.41, p<0.001. Experimenter-rated hyperactivity: step 1: R-squared = 0.19, F (2, 70) = 8.34, Beta = 0.06, 0.41, p<0.001; step 2: R-squared change = 0.10, F change (3, 69) = 9.31, Beta = -.33, p<0.001.

Table 5.5: Proportion of variance in teacher-rated conduct problems explained by non-verbal IQ (β, R^2 change), after controlling for hyperactivity

	Teacher-rated conduct problems	
	β	R^2 change
Step1:		
Parent-rated hyperactivity	.073	.323***
Teacher-rated hyperactivity	.435**	
Exptr-rated hyperactivity	.135	
Step 2:		
Non-verbal IQ	-.006	.000

*p<0.05; ***p<0.001

Table 5.6: Proportion of variance in hyperactivity explained by non-verbal IQ (β, R^2 change), after controlling for conduct problems

	Parent hyperactivity		Teacher hyperactivity		Experimenter hyperactivity	
	β	R^2 change	β	R^2 change	β	R^2 change
Step1:						
Parent-rated conduct	.374**	.221***	.074	.312***	.063	.192***
Teacher-rated conduct	.178		.526***		.411***	
Step 2:						
Non-verbal IQ	-.210†	.040†	-.409***	.150***	-.327**	.096**

† non-significant trend (p<0.10); **p<0.01; ***p<0.001

In summary, data derived from the regression equations indicate that non-verbal ability accounted for unique, independent variance in teacher-rated conduct problems over and above that explained by verbal ability. However, this finding was accounted for by the fact that high levels of hyperactivity tend to co-occur with high levels of conduct problems, and that it is hyperactivity rather than conduct problems that is associated with low non-verbal IQ. This was reflected in the finding that removing the variance explained by hyperactivity resulted in the association between non-verbal IQ and teacher-rated conduct problems falling below significance. Non-verbal ability did, on the other hand, account for unique variance in teacher and experimenter-rated hyperactivity, independently of conduct problems. The independent contribution of non-verbal IQ to variance in parent-rated hyperactivity, over and above that of conduct problems, also approached significance.

Summary of results: *Conduct problems were not significantly associated with any aspect of cognition independently of hyperactivity. Hyperactivity was significantly negatively associated with non-verbal IQ, and this association remained significant for teacher and experimenter-rated hyperactivity (and approached significance for parent-rated hyperactivity) even after controlling for conduct problems. The negative association between hyperactivity and verbal ability was accounted for by shared variance with non-verbal IQ, indicating that non-verbal IQ was the only aspect of cognition which independently predicted hyperactivity.*

5.3.4 Associations between conduct problems, hyperactivity and theory of mind & inhibitory control

Aims and hypotheses: *Conduct problems are not expected to be significantly associated with ToM or IC independently of hyperactivity. In contrast, we predict that teacher and experimenter-rated hyperactivity will be significantly negatively associated with both ToM and IC, even after controlling for the variance explained by conduct problems. Parent-rated hyperactivity is not hypothesised to be significantly associated with ToM or IC.*

Table 5.7 demonstrates that theory of mind and inhibitory control were significantly positively associated with non-verbal IQ and verbal ability. This indicates that having high non-verbal IQ and verbal ability scores was associated with performing well on theory of mind and inhibitory control tasks. All associations were relatively small in magnitude, with r ranging from .35 through to .46, indicating that ToM and IC had around 12 – 21% of variance in common. These significant associations indicated that the analyses reported below should control for verbal and non-verbal ability.

Table 5.7: Pearson's correlations between theory of mind, inhibitory control, IQ and verbal ability *(and partialled for non-verbal IQ and verbal ability)*

Measure	Non-verbal IQ◊	Verbal ability◊◊	ToM
ToM	.35*** *(.17*)* N=147	.39*** *(.26**)* N=144	
IC	.46*** *(.30***)* N=147	.42*** *(.22**)* N=144	.46*** *(.36***)* N=147

*p<0.05; **p<0.01; ***p<0.001
◊Only partialled for verbal ability; ◊◊Only partialled for non-verbal IQ

Table 5.8 reveals that, as hypothesised, ToM and IC were not significantly associated with parent-rated conduct problems. However, teacher-rated conduct problems were significantly negatively associated with both ToM (r=-.21, p<0.05) and IC (r=-.27, p<0.01). These associations were weak in magnitude, and indicative of 4 - 7% of variance in common. Parent-rated hyperactivity was not expected to be significantly associated with either aspect of cognition, yet was in fact significantly negatively associated with IC (r=-.20, p<0.05). Again, this was a weak association, reflecting 4% of common variance shared between parent-rated hyperactivity and IC.

As hypothesised, teacher and experimenter-rated hyperactivity were significantly negatively associated with both ToM (teacher-rated: r=-.20, p<0.05; experimenter-rated: r=-.33, p<0.001) and IC (teacher-rated: r=-.33, p<0.001; experimenter-rated: r=-.47, p<0.001). The associations were all weak in magnitude, reflecting between 4 and 22% of common variance between these school and nursery-based hyperactivity ratings and ToM and IC task performance. Overall, being hyperactive was associated with poorer performance on ToM and IC tasks.

Table 5.8: Pearson's correlations between conduct problems, hyperactivity, theory of mind and inhibitory control

Measure	ToM	IC
Parent-rated conduct problems	-.03 N=103	-.19 N=103
Teacher-rated conduct problems	-.21* N=102	-.27** N=102
Parent-rated hyperactivity	-.03 N=103	-.20* N=103
Teacher-rated hyperactivity	-.20* N=102	-.33*** N=102
Experimenter-rated hyperactivity	-.33*** N=147	-.47*** N=147

*$p<0.05$; **$p<0.01$; ***$p<0.001$

Table 5.9 reveals that IC, but not ToM, contributed significant independent variance to teacher-rated conduct problems. Thus, over and above the variance explained by ToM, IC accounted for a further 4.1% (step 1 (ToM): R-squared = 0.04, F (1, 100) = 4.38, Beta = -.21, $p<0.05$; step 2 (ToM, IC): R-squared change = 0.04, Beta = -.23, $p<0.05$). Thus, ToM was only associated with teacher-rated conduct problems by virtue of its association with IC, whereas IC was significantly and independently associated with teacher-rated conduct problems. IC also emerged as the strongest and only significant aspect of cognition to predict teacher and experimenter-rated hyperactivity (table 5.10), with 7% of unique variance in teacher-rated conduct problems and 12.6% of unique variance in experimenter-rated conduct problems accounted for by IC over and above ToM: Teacher-rated hyperactivity: Step 1 (ToM): R-squared = 0.04, F (1, 100) = 4.06, Beta = -.20. $p<0.05$; step 2 (ToM, IC): R-squared change = 0.07, F change (2, 99) = 7.83, Beta = -.30, $p<0.01$. Experimenter-rated hyperactivity: step 1: R-squared = 0.11, F (1, 145) = 17.32, Beta = -.33, $p<0.001$; step 2 (ToM, IC): R-squared change = 0.13, F change (2, 144) = 23.60, Beta = -.40, $p<0.001$.

Table 5.9: Proportion of variance in teacher-rated conduct problems explained by ToM and IC (β, R^2 change)

	Teacher-rated conduct problems	
	β	R^2 change
Step1: ToM	-.205*	.042*
Step 2: IC	-.229*	.041*
Step1: IC	-.274**	.075**
Step 2: ToM	-.100	.008

*p<0.05; **p<0.01

Table 5.10: Proportion of variance in teacher and experimenter-rated hyperactivity explained by ToM and IC (β, R^2 change)

	Teacher hyperactivity		Experimenter hyperactivity	
	β	R^2 change	β	R^2 change
Step1: ToM	-.197*	.039*	-.327***	.107***
Step 2: IC	-.298**	.070**	-.399***	.126***
Step1: IC	-.326***	.106***	-.465***	.216***
Step 2: ToM	-.061	.003	-.145†	.017†

† non-significant trend (p<0.10); *p<0.05; **p<0.01; ***p<0.001

Nevertheless, despite the fact that IC consistently emerged as the strongest and only significant independent predictor of conduct problems and hyperactivity, for the most part this was due to the variance shared between IC and non-verbal IQ and verbal ability. Thus, IC no longer predicted unique variance in teacher-rated conduct problems (2.3%, see table 5.11), parent-rated hyperactivity (0.4%, see table 5.12), or teacher-rated hyperactivity (0.5%, see table 5.11), once the variance explained by non-verbal IQ and verbal ability had been accounted for. Nevertheless, table 5.12 illustrates that the association between IC and experimenter-rated hyperactivity was independent of non-verbal IQ and verbal ability, with a unique 7.7% of the variance accounted for by IC over and above these other aspects of cognition (step 1 (non-verbal IQ, verbal ability): R-squared = 0.20, $F(2, 141) = 18.12$, Beta = -.35, -.15, $p<0.001$; step 2 (non-verbal IQ, verbal ability, IC): R-squared change = 0.08, F change $(3, 140) = 15.02$, Beta = -.32, $p<0.001$).

Table 5.11: Proportion of variance in teacher-rated conduct problems explained by IC (β, R^2 change), after controlling for non-verbal IQ and verbal ability

	Teacher-rated conduct problems	
	β	R^2 change
Step1:		
Non-verbal IQ	-.335**	.104**
Verbal ability	.025	
Step 2:		
IC	-.175	.023

*p<0.05; **p<0.01; ***p<0.001

Table 5.12: Proportion of variance in parent, teacher and experimenter-rated hyperactivity explained by IC (β, R^2 change), after controlling for non-verbal IQ and verbal ability

	Parent hyperactivity		Teacher hyperactivity		Experimenter hyperactivity	
	β	R^2 change	β	R^2 change	β	R^2 change
Step1:						
Non-verbal IQ	-.233*	.095**	-.492***	.305***	-.350***	.204***
Verbal ability	-.110		-.099		-.152	
Step 2:						
IC	-.069	.004	-.080	.005	-.320***	.077***

*p<0.05; **p<0.01; ***p<0.001

The association between experimenter-rated hyperactivity and IC was also the only association to remain significant after taking conduct problems and hyperactivity into account. Thus, only a further 0.4% of the variance in teacher-rated conduct problems was explained by IC after taking hyperactivity into account (table 5.13), and only 0.8% of the variance in parent-rated hyperactivity and 3.1% of the variance in teacher-rated hyperactivity (table 5.14) was accounted for by IC after taking account of the variance explained by conduct problems. IC did, however, account for a unique 12.6% of the variance in experimenter-rated hyperactivity, independently of conduct problems (step 1 (parent-rated conduct problems, teacher-rated conduct problems): R-squared = 0.19, F (2, 70) = 8.34, Beta = 0.06, 0.41, $p<0.001$; step 2 (parent-rated conduct problems, teacher-rated conduct problems, IC): R-squared change = 0.13, F change (3, 69) = 12.78, Beta = -.37, $p<0.001$).

Table 5.13: Proportion of variance in teacher-rated conduct problems explained by IC (β, R^2 change), after controlling for hyperactivity

	Teacher-rated conduct problems	
	β	R^2 change
Step1:		
Parent-rated hyperactivity	.073	.323***
Teacher-rated hyperactivity	.435**	
Experimenter-rated hyperactivity	.135	
Step 2:		
IC	-.070	.004

*p<0.05; **p<0.01; ***p<0.001

Table 5.14: Proportion of variance in parent, teacher and experimenter-rated hyperactivity explained by IC (β, R^2 change), after controlling for conduct problems

	Parent hyperactivity		Teacher hyperactivity		Experimenter hyperactivity	
	β	R^2 change	β	R^2 change	β	R^2 change
Step1:						
Parent-rated conduct	.374**	.221***	.074	.312***	.063	.192***
Teacher-rated conduct	.178		.526***		.411***	
Step 2:						
IC	-.094	.008	-.183†	.031†	-.371	.126***

†non-significant trend (p<0.10); *p<0.05; **p<0.01; ***p<0.001

Summary of results: *ToM and IC were not significantly associated with parent-rated conduct problems. Teacher-rated conduct problems were significantly negatively associated with ToM and IC, though not independently of non-verbal IQ and verbal ability or hyperactivity. IC uniquely (negatively) predicted all aspects of hyperactivity independently of ToM, but only the negative association between experimenter-rated hyperactivity and IC remained significant after controlling for non-verbal IQ, verbal ability and conduct problems.*

5.3.5 Comparison of chapter 4 categorical analyses with chapter 5 dimensional analyses with regard to conduct problems

Objectives and hypotheses: *To determine whether results found at extreme ends of the behavioural distribution with regard to conduct problems would also be found across the sample as a whole, in terms of associations between conduct problems and various aspects of cognitive functioning (non-verbal IQ, verbal ability, ToM and IC). We anticipated that results of the two chapters would be comparable.*

Table 5.15 summarises the results from chapters 4 and 5 side-by-side. Chapter 4 was concerned with mean differences between scores on verbal ability, non-verbal ability, ToM and IC measures in children with conduct problems and control children with low levels of conduct problems. Chapter 5 on the other hand was concerned with correlations between the measures and conduct problems, and was also able to distinguish between parent and teacher-rated conduct problems.

With regard to the association between non-verbal IQ and conduct problems, chapter 4 categorical analyses of "at risk" versus "low risk" children (with high versus low levels of conduct problems a year earlier) indicated that children with high levels of conduct problems had significantly lower non-verbal IQs than children with low levels of conduct problems. Dimensional analyses in chapter 5 revealed that across the sample as a whole at age 4, parent-rated conduct problems showed no significant association with non-verbal IQ, whilst teacher-rated conduct problems were significantly negatively associated with non-verbal IQ. Verbal ability was reported to be significantly higher in "at risk" than "low risk" children in chapter 4, yet this was not replicated across the sample as a whole (chapter 5), with no significant associations emerging between verbal ability and conduct problems.

The "at risk" and "low risk" children did not differ in their performance on tasks measuring ToM and IC ability at age 4. In the dimensional analyses at age 4, teacher, but not parent-rated conduct problems were significantly negatively associated with ToM and IC, thus only partially consistent with chapter 4.

Table 5.15: Associations between conduct problems and non-verbal ability, verbal ability, ToM and IC in categorical analyses versus dimensional analyses

Measure	Categorical (chapter 4)	Dimensional (chapter 5)	
Non-verbal IQ	√	P	x
		T	√
Verbal ability	√	P	x
		T	x
ToM	x	P	x
		T	√
IC	x	P	x
		T	√

x = No significant mean difference between at risk" and "low risk" on measure (categorical) or no significant correlation between conduct problems and measure (dimensional)

√ = Significant mean difference between "at risk" and "low risk" on measure (categorical) or significant correlation between conduct problems and measure (dimensional)

Trend = Trend towards mean difference between "at risk" and "low risk" on measure (categorical) or trend towards correlation between conduct problems and measure (dimensional)

Summary of results: *Consistency across the age 4 categorical and dimensional chapters was mixed, with a particularly marked discrepancy between the chapters with regard to the association between verbal ability and conduct problems. In the categorical chapter, verbal ability was significantly poorer in the "at risk" than "low risk" group, yet in the dimensional analyses conduct problems and verbal ability were not significantly associated.*

5.4 Discussion

5.4.1 Associations between conduct problems, hyperactivity, non-verbal IQ and verbal ability at age 4

Tables 5.16 and 5.17 display the findings with regard to the cross-sectional associations between conduct problems and non-verbal IQ and verbal ability, and between hyperactivity and non-verbal IQ and verbal ability, at age 3 and age 4, side by side for direct comparison. Areas highlighted in red illustrate ratings of behaviour which are significantly negatively associated with a given aspect of cognition across all sets of analyses at one time point. Thus, the association is not only significant but also contributes significant variance independently of verbal or non-verbal ability, and independently of conduct problems or hyperactivity. In short, the red areas highlight the highly significant associations which are robust and independent of other influences at least across one time-point.

Three key patterns of findings are evident from these tables. Firstly, hyperactivity emerged at both time-points as consistently positively associated with both non-verbal IQ and verbal ability, largely independently of conduct problems, and with the association between non-verbal ability and hyperactivity consistently independent of verbal ability. Conduct problems on the other hand showed some indication of a specific association (i.e. independent of the other aspect of cognition and independent of hyperactivity) with verbal ability only. Even this specific association was limited to parent-rated conduct problems, and was no longer apparent by age 4. In sum, hyperactivity emerged as more pervasively and consistently negatively associated with non-verbal and verbal ability than did conduct problems across time, and the associations were largely independent of co-morbid conduct problems. This latter point suggests that hyperactivity specifically was associated with poor cognition, and a "conduct problems + hyperactivity" profile on the part of some of the children did not better account for the findings.

Secondly, the role of verbal ability in association with both conduct problems and hyperactivity was much stronger at age 3 than at age 4. Thus, for example, a significant negative correlation of -.27 emerged between parent-rated conduct problems and verbal ability at age 3, with verbal ability still accounting for a further significant 4.5% of the variance in parent-rated conduct problems independently of non-verbal ability and a further 2.1% of the variance independently of hyperactivity.

At age 4 on the other hand the correlation was a non-significant -.17, with verbal ability no longer accounting for a significant proportion of the variance over and above non-verbal ability (1.4%) or hyperactivity (0.2%). A similar pattern was evident with regard to the association between verbal ability and hyperactivity. Teacher-rated hyperactivity for example, though significantly negatively associated with verbal ability to a similar moderate magnitude at age 3 and age 4 (-.38 at age 3 compared with -.34 at age 4), was no longer independently predicted by verbal ability, over and above non-verbal ability, at age 4. Thus, a further 5.2% of the variance in teacher-rated conduct problems was accounted for by verbal ability over and above non-verbal ability at age 3, compared with only 0.7% at age 4.

The third point to note from tables 5.16 and 5.17 is that associations between both verbal ability and non-verbal IQ and hyperactivity were generally stronger for hyperactivity ratings in the nursery or school context than at home, particularly at age 4. For example, at age 4 the association between non-verbal ability and parent-rated hyperactivity, whilst significant at r= -.29, was a modest association in comparison to the correlations of -.55 between non-verbal ability and teacher-rated hyperactivity and -.43 between non-verbal ability and experimenter-rated hyperactivity. Furthermore, whilst a significant 3.8% of the variance in parent-rated hyperactivity was accounted for by non-verbal ability independently of verbal ability, this was a small proportion of variance compared with the 16.9% of independent variance in teacher-rated hyperactivity and 8.6% of variance in experimenter-rated hyperactivity accounted for by non-verbal ability. Why might cognition and hyperactivity be more strongly associated at nursery than at home? Perhaps having poor verbal or non-verbal competency is more likely, in accordance with Goodman et al's (1995) *low IQ is a cause* conjecture, to lead to frustration and therefore hyperactive behaviour, in a busy or stimulating environment. The fact that the discrepancy between home and school ratings appears to widen between the ages of 3 and 4 suggests that possibly the greater academic and social demands of school as opposed to nursery, might increase the impact of poor cognition on behaviour. Nevertheless, this account is still difficult to equate with the finding that the association between verbal ability and conduct problems at age 3 was specific to parent ratings as opposed to teacher or experimenter ratings.

Table 5.16: Non-verbal ability x Conduct problems and hyperactivity at age 3 and age 4

	Conduct problems					
	Pearson's correlation		Independent contribution after verbal: R^2 ch		Independent contribution after hyperactivity: R^2 ch	
	NVIQ	**NVIQ**	**NVIQ**	**NVIQ**	**NVIQ**	**NVIQ**
	Age 3	Age 4	Age 3	Age 4	Age 3	Age 4
P conduct	-.17 n.s.	-.13 n.s.	0.2% n.s.	0.2% n.s.	0.0% n.s.	0.2% n.s.
T conduct	-.24***	-.32***	0.8% n.s.	7.9% **	0.0% n.s.	0.0% n.s.
	Hyperactivity					
	Pearson's correlation		Independent contribution after verbal: R^2 ch		Independent contribution after conduct: R^2 ch	
	NVIQ	**NVIQ**	**NVIQ**	**NVIQ**	**NVIQ**	**NVIQ**
	Age 3	Age 4	Age 3	Age 4	Age 3	Age 4
P hyp	-.30***	-.29**	4.0% **	3.8% *	4.6% **	4.0%†
T hyp	-.37***	-.55***	4.2% **	16.9% ***	5.0% ***	15.0% ***
E hyp	-.27***	-.43***	2.0% *	8.6% ***	3.4% *	9.6% **

†non-significant trend ($p<0.10$); *$p<0.05$; **$p<0.01$; ***$p<0.001$

Table 5.17: Verbal ability x Conduct problems and hyperactivity at age 3 and age 4

	Conduct problems					
	Pearson's correlation		Independent contribution after NVIQ: R^2 ch		Independent contribution after hyperactivity: R^2 ch	
	Verbal	**Verbal**	**Verbal**	**Verbal**	**Verbal**	**Verbal**
	Age 3	Age 4	Age 3	Age 4	Age 3	Age 4
P conduct	-.27***	-.17 n.s.	4.5% **	1.4% n.s.	2.1% *	0.2% n.s.
T conduct	-.32***	-.16 n.s.	5.2% **	0.0% n.s.	0.7% n.s.	0.5% n.s.
	Hyperactivity					
	Pearson's correlation		Independent contribution after NVIQ: R^2 ch		Independent contribution after conduct: R^2 ch	
	Verbal	**Verbal**	**Verbal**	**Verbal**	**Verbal**	**Verbal**
	Age 3	Age 4	Age 3	Age 4	Age 3	Age 4
P hyp	-.25***	-.24*	0.1% n.s.	0.9% n.s.	1.4% n.s.	2.2% n.s.
T hyp	-.38***	-.34***	5.0% **	0.7% n.s.	3.5% **	7.7% **
E hyp	-.29***	-.34***	3.1% **	1.6% n.s.	3.1% *	7.5% **

*p<0.05; **p<0.01; ***p<0.001

Taken together, these results are indicative of a high degree of instability in the associations between cognition and behaviour in the pre-school years. Had we simply tested these children at age 3, we would have concluded that our findings fitted neatly alongside many reported findings in the literature. The results would suggest that a verbal impairment is evident in the presence of conduct problems not only in older, clinical samples (e.g. Moffitt, 1990), but also across more normative variations in levels of conduct problems, and emerging very early in development. We would also conclude that a more pervasive profile of negatively associated cognitive processes characterised hyperactivity, reflecting a strong underlying cognitive vulnerability which is perhaps more general than that associated with conduct problems (Nigg & Huang-Pollock, 2003). The pattern of results at age 4, however, was not as strongly indicative of the importance of verbal ability in conduct problems. This might urge some caution in drawing strong conclusions from the age 3 data.

Many studies investigating associations between cognition and behaviour have, of course, been conducted cross-sectionally, with the exception of a few longitudinal investigations (Plomin et al, 2002; Moffitt et al, 2001; Nigg et al, 1999), and thus perhaps associations are not as developmentally stable as the literature might suggest. It is likely, however, that the pre-school period constitutes a particularly transitional period, with a vast number of changes and influences such as starting nursery or school, which could significantly alter both behaviour and cognition over the relatively short period of time between assessments. The suggestion is therefore that one should perhaps exert some degree of caution in interpreting cross-sectional findings from studies of pre-schoolers. Perhaps behaviour and cognition are subject to such a high degree of change during this period that one cannot make accurate predictions about the future developmental trajectories of children based on findings at age 3.

One comparable study which did address longitudinal associations between cognition and behaviour in a community sample over the pre-school period, reported a somewhat different pattern of findings to the present study. Plomin et al (2002) investigated associations between verbal and non-verbal ability and parent-rated behaviour (incorporating anxiety, conduct problems and hyperactivity), at age 2, 3 and 4. They reported modest negative associations between behaviour, regardless of the particular aspect of behaviour, and verbal and non-verbal ability. Associations were stronger for non-verbal than verbal ability across all time points, and between the ages of 3 and 4 associations between behaviour and verbal ability increased, though this was not true of non-verbal ability. Plomin et al only used parental ratings of behaviour, and thus comparisons between the data sets shall focus only on parent-rated conduct and hyperactivity ratings.

The first difference to note is that associations were similar across different aspects of behaviour, thus there was no indication (though the data for the sub-scales separately are not reported) of a stronger negative association between cognition and hyperactivity than between cognition and conduct problems. Correlations are reported separately for boys and girls, and for the total problems score only, thus comparability is limited. At age 3, correlations between non-verbal ability and behaviour in Plomin et al's study were -.25 and -.22 for boys and girls respectively, whereas in the present study correlations were -.17 and -.30 for conduct problems and hyperactivity respectively. At age 4 correlations in Plomin et al's study were -.27 for boys and -.24 for girls, compared with -.13 for conduct problems and -.29 for hyperactivity.

With regard to verbal ability, Plomin et al's reported correlations with behaviour at age 3 for boys and girls respectively were -.13 and -.09, compared with correlations of -.27 for conduct problems and -.25 for hyperactivity in the present study. At age 4, Plomin et al's correlations were -.18 for boys and -.15 for girls, whereas in the present study they were -.17 for conduct problems and -.24 for hyperactivity.

The main difference between the findings therefore seems to be with regard to verbal ability at age 3. Plomin et al's correlations for non-verbal ability fall somewhere in between the conduct problems and hyperactivity correlations in the present study at both time points. Their set of correlations would therefore be likely to correspond with a total problems score in the current data set if we were to combine our hyperactivity and conduct problems ratings. At age 3, our correlations between behaviour and verbal ability, in contrast, were a great deal higher than Plomin et al's correlations, but the two sets of correlations look much more similar at age 4. In our data set there was not an increase in the extent to which behaviour problems were associated with verbal ability over time, in fact for conduct problems the association decreased between age 3 and age 4.

Without teacher ratings of behaviour in the Plomin et al study with which to compare to the present findings, the picture is far from complete. In general, however, the pattern of results suggests that in the present sample a greater degree of variability over time was evident than in Plomin et al's sample with regard to the strength of associations between behaviour and cognition. This could be because our sample was drawn from a particularly high-risk population, in which the extent of behavioural pathology identified at age 3 was perhaps higher. Without comparable measures of behaviour across the two studies, we cannot be sure if this was in fact the case. In a sample with higher levels of pathology, greater variation over time in accordance with regression to the mean would be expected, and this is thus a conceivable explanation for the discrepant findings.

It seems therefore that in selecting a very young and very behaviourally disturbed group of children, we have obtained a very unstable pattern of data across the two time points. It is plausible that theories attesting to conduct problems or hyperactivity above a clinical threshold in older children do apply to individual differences in levels of behaviour in 3-year-olds. Our data at age 3 certainly indicated this. Perhaps, however, pre-school children are more adaptable and responsive to changes in their environment, such that a combination of behavioural pathology and poor cognition that would be concerning in an older child would not necessarily constitute a poor long-term prognosis in a child so young.

5.4.2 Associations between conduct problems, hyperactivity, theory of mind and inhibitory control at age 4

Tables 5.18 and 5.19 present the time 1 and time 2 data with regard to the associations between conduct problems and ToM and IC, and between hyperactivity and ToM and IC. Overall, the pattern was similar to that reported with regard to non-verbal IQ and verbal ability. Namely, stronger associations were evident, at both time-points, between hyperactivity and ToM and IC than between conduct problems and ToM and IC, with associations between these aspects of cognition and hyperactivity largely independent of co-morbid conduct problems. As an example, teacher-rated conduct problems at age 3 were not significantly negatively associated with ToM ($r = -.09$), whereas teacher-rated hyperactivity and ToM were significantly negatively associated at $r = -.26$. Further, only 0.6% of the variance in teacher-rated conduct problems was accounted for by ToM after controlling for variance explained by hyperactivity. In contrast, a significant 4% of the variance in teacher-rated hyperactivity was accounted for by ToM over and above the variance explained by conduct problems. This pattern was generally consistent across ToM and IC and across age 3 and age 4.

As reported with regard to associations between verbal and non-verbal ability and hyperactivity, associations between ToM and IC and hyperactivity were stronger for teacher and experimenter-rated hyperactivity in the nursery or school context than for parent-rated hyperactivity. Again, this could indicate a tendency for cognition to more strongly influence behaviour in a busy or demanding academic and social environment such as at school or nursery.

In general the results support the notion that poor ToM and IC could be more strongly associated with high levels of hyperactivity (at least at nursery) than high levels of conduct problems (Buitelaar et al, 1999; Berlin & Bohlin, 2002). Before we can conclude that the results indicate a more pervasive set of cognitive correlates in hyperactivity than conduct problems, a more detailed consideration is warranted of the fact that the associations were not consistently independent of non-verbal IQ and verbal ability. ToM, for example, contributed only a further 1.4% of variance in teacher-rated hyperactivity at age 3, and 0% at age 4, after taking into account variance explained by non-verbal IQ and verbal ability. Similarly, IC accounted for only 0.8% of the variance in teacher-rated hyperactivity at age 3 and 0.5% at age 4, over and above that explained by non-verbal IQ and verbal ability. Thus, contrary to theories such as Barkley's (1997) inhibition hypothesis, associations with specialised cognitive processes such as IC may merely reflect a general intelligence deficit rather than a specific IC impairment. Of course, the results may reflect the fact that we examined associations between hyperactivity *across the whole sample* and cognition, rather than focusing on a clinical group such as children with ADHD on which theories such as Barkley's are based. Perhaps therefore, the reason that Hughes et al (1998) reported deficits in IC in their "hard to manage" children even though they were of a comparable age group to the present sample, and Barkley (1997) proposed IC as a core deficit in ADHD, independently of general intelligence, is that these specific associations only apply to children with clinically-relevant or very extreme levels of hyperactivity.

With regard to experimenter-rated hyperactivity, the negative association with ToM and IC was independent of non-verbal IQ and verbal ability at both time points. This could indicate that in very demanding situations such as during the direct testing in the present study, being impaired in the capacity to inhibit responses or to mentalise, does result in hyperactivity, but that this does not manifest itself in hyperactive behaviour most of the time as most situations do not call upon IC or ToM skills to such a great extent. When children are older they may experience increasingly demanding situations, such as longer hours at school, more complex tasks to learn, more difficult school work and more sophisticated and important relationships with peers. Therefore, their IC and ToM impairments might begin to affect their behaviour. Consequently, in later childhood perhaps we might begin to see an association between hyperactivity and ToM and IC which is independent of general intellectual ability. The finding that experimenter-rated hyperactivity was more strongly associated with ToM and IC than the other hyperactivity ratings, as discussed in chapter 3, might alternatively reflect a bias on the part of experimenters. They tested IC skills and rated the children's behaviour, and thus the extent to which one rating may have influenced perceptions of the other cannot be entirely ruled out.

Table 5.18: ToM x Conduct problems and hyperactivity at age 3 and age 4

	Conduct problems					
	Pearson's correlation		Independent contribution after NVIQ & verbal: R^2 change		Independent contribution after hyperactivity: R^2 change	
	ToM	**ToM**	**ToM**	**ToM**	**ToM**	**ToM**
	Age 3	Age 4	Age 3	Age 4	Age 3	Age 4
P conduct	-.13 n.s.	-.03 n.s.	0.2% n.s.	0.3% n.s.	0.5% n.s.	0.0% n.s.
T conduct	-.09 n.s.	-.21 *	0.1% n.s.	1.2% n.s.	0.6% n.s.	0.6% n.s.
	Hyperactivity					
	Pearson's correlation		Independent contribution after NVIQ & verbal: R^2 change		Independent contribution after conduct: R^2 change	
	ToM	**ToM**	**ToM**	**ToM**	**ToM**	**ToM**
	Age 3	Age 4	Age 3	Age 4	Age 3	Age 4
P hyp	-.08 n.s.	-.03 n.s.	0.0% n.s.	1.1% n.s.	0.1% n.s.	0.0% n.s.
T hyp	-.26 ***	-.20 *	1.4% n.s.	0.0% n.s.	4.0% **	0.8% n.s.
E hyp	-.25 ***	-.33***	2.3% *	2.6% *	4.7% **	6.1% *

*p<0.05; **p<0.01; ***p<0.001

Table 5.19: IC x Conduct problems and hyperactivity at age 3 and age 4

	Conduct problems					
	Pearson's correlation		Independent contribution after NVIQ & verbal: R² change		Independent contribution after hyperactivity: R² change	
	IC	**IC**	**IC**	**IC**	**IC**	**IC**
	Age 3	Age 4	Age 3	Age 4	Age 3	Age 4
P conduct	-.12 n.s.	-.19 n.s.	0.1% n.s.	1.4% n.s.	0.1% n.s.	0.5% n.s.
T conduct	-.19 n.s.	-.27 **	0.5% n.s.	2.3% n.s.	0.1% n.s.	0.4% n.s.
	Hyperactivity					
	Pearson's correlation		Independent contribution after NVIQ & verbal: R² change		Independent contribution after conduct: R² change	
	IC	**IC**	**IC**	**IC**	**IC**	**IC**
	Age 3	Age 4	Age 3	Age 4	Age 3	Age 4
P hyp	-.17 n.s.	-.20 *	0.3% n.s.	0.4% n.s.	1.0% n.s.	0.8% n.s.
T hyp	-.25 ***	-.33 ***	0.8% n.s.	0.5% n.s.	1.7% *	3.1% †
E hyp	-.33 ***	-.47 ***	4.9% ***	7.7% ***	6.8% ***	12.6% ***

†non-significat trend (p<0.10); *p<0.05; **p<0.01; ***p<0.001

5.4.3 Comparison of findings from chapter 4 categorical analyses and chapter 5 dimensional analyses

At age 3 we reported that the associations between conduct problems and cognition were largely consistent across both the categorical analyses, which focused on children with extremely high or low levels of conduct problems, and the dimensional analyses, which looked more generally at the associations across the sample as a whole. The most important consistent finding was the significant negative association between conduct problems and verbal ability, which applied to the extreme ends of the behavioural continuum and to the whole range of conduct problems across the whole sample.

At age 4, however, in the categorical analyses, the children in the "at risk" group (with high levels of conduct problems) presented with significantly poorer verbal ability than the "low risk" group (with low levels of conduct problems), whereas in the dimensional analyses there emerged no significant association between conduct problems and verbal ability. However, if we consider that in the categorical analyses the "at risk" group no longer presented with significantly poorer verbal ability than the "low risk" group once hyperactivity was controlled for, the results in fact do not look so inconsistent between the categorical and dimensional analyses at age 4. Thus, it seems that the instability over time that was evident across the whole sample, as discussed in the section above, was also apparent at extreme ends of the behavioural distribution.

The results suggest therefore that even amongst children with particularly high levels of conduct problems, at age 3 the associations between conduct problems and verbal ability may not be stable. This has important intervention implications, one of which is to be cautious in predicting a poor prognosis in a very young child with early signs of conduct problems and verbal impairments. Another is that children at this young age could benefit from intervention initiatives aimed at improving their prognosis, since it seems that they may be particularly responsive to influence and change during the pre-school years. Further, children at extreme ends of the behavioural continuum at least at this young age do not appear to be any more stable in terms of their behaviour and cognition than children with less severe behavioural disturbance.

5.5 Chapter summary

- Conduct problems at age 4 were no longer significantly negatively associated with verbal ability, contrary to findings at age 3. Teacher and experimenter-rated hyperactivity, in contrast to data presented at age 3, were no longer independently associated with both non-verbal and verbal ability. All ratings of hyperactivity at age 4 were associated specifically with non-verbal ability.
- The above findings indicate substantial instability in associations between behaviour and cognition in this young, high-risk sample.
- The only significant association with IC and ToM, independent of both non-verbal and verbal ability and conduct problems, was experimenter-rated hyperactivity, although in general associations with ToM and IC were stronger with regard to hyperactivity than with regard to conduct problems.
- Associations between hyperactivity and cognition were stronger for school or nursery-based ratings of behaviour (teacher and experimenter-rated hyperactivity) than for parent-rated hyperactivity.
- Findings with regard to conduct problems in this dimensional, whole sample chapter largely replicated findings in the categorical analyses in chapter 3.

6

Cognitive predictors of conduct problems and hyperactivity: Longitudinal dimensional analyses from age 3 to age 4

6.1 Overview of the literature and chapter aims and hypotheses

As discussed at the beginning of chapter 4, the ideal longitudinal outcome study assessing risk for conduct problems would focus on a sub-set of children with clinically significant levels of conduct problems (e.g. CD), and look retrospectively at the risk factors these children presented with during the pre-school years. In the present study so far, the children are not old enough to be diagnosed with CD, and therefore the focus of the categorical chapters was on the extent to which "early risk" could be meaningfully identified in a group of children so young. Nevertheless, it is still of interest whether some of the aspects of functioning considered as "risk factors" in the categorical chapters, might be predictive of conduct problems a year later, dimensionally across the whole sample. This affords us greater power to detect associations in the larger sample, and also enables us to consider the extent to which the predictors of hyperactivity as a dimension might differ from the predictors of conduct problems. This type of cross-behavioural comparison would not be possible if analyses focused on the sub-set of children at risk for conduct problems, in the absence of a comparable group of children at risk for hyperactivity specifically. Of course, it would have been possible to look at a group of children "at risk" for hyperactivity, but the specific focus of the categorical chapters was on conduct problems.

To be consistent with the cross-sectional dimensional chapters (chapters 3 and 5), the "predictors" of conduct problems and hyperactivity shall focus on cognitive processes, namely verbal ability, non-verbal IQ, theory of mind and inhibitory control. In addition, the extent to which hyperactivity predicts conduct problems, and vice-versa, shall also be addressed. In the cross-sectional chapters there emerged some evidence that hyperactivity showed stronger associations with cognition, particularly non-verbal IQ, than conduct problems. At age 3, but less so at age 4, conduct problems were specifically associated with verbal ability. Might these findings indicate differential longitudinal predictors of conduct problems compared with hyperactivity? This is the question we aim to address in the present chapter.

6.1.1 Longitudinal predictors of conduct problems

Previous studies have reported a specific association between the verbal aspect of cognitive functioning and conduct problems (e.g. Moffitt, 1990; Nigg & Huang-Pollock, 2003). Moffitt (1990), for example, found in her whole-sample analyses, that after controlling for age 5 antisocial behaviour, verbal IQ across all follow-up ages significantly predicted age 11 antisocial behaviour. Such an association could be suggestive of a specific cognitive deficit which impacts primarily upon behaviour in a social context, or alternatively it might reflect the impact of antisocial behaviour on cognitive abilities which are important for social interactions and communication, namely language ability. If a person's social interactions are characterised by aggressive exchanges then perhaps the ability to communicate verbally and to understand what is being communicated verbally is hindered due to lack of positive social experiences from which to learn.

Other theorists have argued that genetic and cognitive vulnerabilities predispose children to conduct problems, but rather more indirectly than is the case for hyperactivity (Raine, 2002; Rutter et al, 1999; Nigg & Huang-Pollock, 2003), via negative life experiences and adverse environmental influences. Thus it is possible that cognition, including aspects of cognition other than verbal ability, could predict conduct problems, but this longitudinal association would not be evident until later in development, once cognitive and genetic vulnerabilities have exposed children to adverse circumstances and their limited resilience has resulted, at a later stage, in conduct problems. Depending on how long one anticipates this process would take, the age at which cognitive impairments might be expected to predict conduct problems would vary. Moffitt (1990) reported that the predictive association between verbal ability and later antisocial behaviour was evident as early as age 5.

Cross-sectional findings in the present study are thus far consistent with the conjecture that verbal ability specifically may be associated conduct problems, even as early as age 3. In chapter 3 it emerged that verbal ability, but not non-verbal ability, contributed unique variance to parent and teacher-rated conduct problems cross-sectionally at age 3. Deficits in verbal ability also characterised the group of children with early conduct problems in chapter 2 and distinguished them from the group of children without early conduct problems more strongly than deficits in non-verbal ability. It is anticipated therefore, based on findings such as Moffitt's (1990) longitudinal study and the cross-sectional results in the present study, that individual differences in verbal ability at age 3 will predict individual differences in levels of conduct problems at age 4. This association will be stronger than the association between non-verbal ability at age 3 and conduct problems at age 4.

To what extent might we expect to find that other aspects of cognition at age 3 could be predictive of conduct problems at age 4? In a longitudinal study investigating the strength of association between aspects of neuropsychological functioning at age 6 (including inhibitory control) and externalising behaviour at age 8, Nigg, Quamma, Greenberg and Kusche (1999) reported modest significant effects. In their community sample, inhibitory control, as measured by the Stroop colour-word task (Golden, 1978), similar to the IC tasks used in the present study, at age 6 was the only significant independent predictor of age 8 externalising behaviour according to teachers. Poor IC at age 6 predicted higher teacher-rated externalising behaviour (incorporating symptoms of both conduct problems and hyperactivity) at age 8, over and above the "auto-correlation effect" of the stability of externalising behaviour over time. Nigg et al's (1999) sample were older than in the present study, and therefore the extent to which the findings may be replicated in a younger sample will be of interest in the present chapter. We considered the Stroop colour-word task to be a comparable measure of inhibition to the tasks used in the present study, although see Wright, Waterman, Prescott and Murdoch-Eaton (2001) for a detailed comparison of the Day/Night and Stroop colour-word tasks. In the present study at age 3, theory of mind and inhibitory control were not associated with conduct problems, either across the sample as a whole (chapter 3) or in the extreme ends of the behavioural distribution with regard to conduct problems (chapter 2). Nevertheless, this is not to say that theory of mind and inhibitory control would not be expected to predict conduct problems a year later. In fact, based on Nigg et al's (1999) findings that in older children these aspects of cognition are predictive of later externalising problems, and that associations between theory of mind and inhibitory control and conduct problems can be evident as early as age 4, it is hypothesised that IC and ToM at age 3 shall predict conduct problems at age 4.

However, should our findings attest to the notion that IC and ToM at age 3 are predictive of conduct problems at age 4, some degree of caution is warranted in interpreting the findings. Neither Nigg et al (1999) nor Hughes et al (1998) attempted to separate conduct problems and hyperactivity or to control for the presence of one or other aspect of externalising behaviour in examining the outcome. This is an important issue to address, since some researchers (e.g. Berlin & Bohlin, 2002; Buitelaar et al, 1999), have reported that in fact conduct problems are not associated with ToM or IC, independently of hyperactivity. Therefore, if findings support our above hypothesis, the present chapter shall also investigate the extent to which ToM and IC at age 3 still predict conduct problems at age 4 once the variance explained by hyperactivity at age 3 has been statistically accounted for. It is hypothesised that controlling for the variance accounted for by hyperactivity will result in the predictive power of age 3 ToM and IC in predicting conduct problems at age 4, falling below significance. In contrast, a specific verbal deficit has been proposed to underlie antisocial behaviour (Moffitt, 1990). Furthermore, in chapter 2 of the present study verbal ability continued to significantly distinguish between the "at risk" and "low risk" group even when controlling for hyperactivity. Therefore it is hypothesised that verbal ability at age 3 will emerge as a significant independent predictor of age 4 conduct problems, even after taking into account the variance explained by time 1 hyperactivity.

As well as controlling for the potentially confounding effect of hyperactivity in examining the cognitive predictors of conduct problems, hyperactivity itself was also considered as a predictor of conduct problems. Hyperactivity has long been considered a risk factor in the literature, for particularly severe and persistent conduct problems, since it has been associated with a profile of antisocial behaviour that is enduring and predictive of later criminality or personality disorder (Babinski et al, 1999; Lynam, 1996, 1998). Indeed, in chapter 2, hyperactivity was found to differentiate children with early conduct problems from children without early conduct problems. In the set of analyses in the present chapter it was hypothesised that hyperactivity at age 3 in the sample as a whole would predict conduct problems at age 4. This was based on previous longitudinal findings reporting that early hyperactivity predicts later conduct problems (e.g. Moffitt et al, 2001). Also forming the basis for our hypothesis was the theory proposed by some researchers that conduct problems are often preceded by hyperactivity, such that hyperactivity may be considered an early form of externalising behaviour which eventually develops into conduct disorder (Patterson, DeGarmo & Knutson, 2000). This theory was based on clinical levels of hyperactivity and conduct problems such as AD/HD and CD. Nevertheless, we anticipated that as well as being true at extreme ends of the behavioural distribution, this theory would apply to individual differences in levels of cognition and behaviour across the whole sample.

6.1.2 Longitudinal predictors of hyperactivity

Hyperactivity, though closely associated with conduct problems and highly co-morbid, has been proposed to be associated with a more pervasive profile of cognitive impairment than that of conduct problems. Rutter et al (1999), for example, argued that genetic vulnerability has a direct influence on hyperactivity but is mediated by the environment with regard to conduct problems. This notion is similar to Nigg and Huang-Pollock's (2003) theory of cognitive vulnerability which again was proposed to directly impact upon hyperactivity but to take longer to manifest into conduct problems via interactions with environmental influences. Studies of older children with established clinically diagnosed behaviour problems have also reported that cognitive impairments are more pronounced in children with hyperactivity than those with conduct problems. Buitelaar et al (1999) for example found theory of mind deficits in children with ADHD but not in children with conduct problems, and suggested that frontal theories of ADHD (e.g. Barkley, 1997) were perhaps not as applicable to children with conduct problems as some theorists (e.g. Raine, 2002) have suggested. Buitelaar et al (1999) therefore proposed, in line with Rutter et al (1999), that cognitive impairments are stronger and more pervasive in children with hyperactivity. Unlike studies concerned with conduct problems and anti-social behaviour (e.g. Moffitt et al, 2001), a specific deficit in one aspect of cognitive functioning such as verbal ability has not been proposed to underlie hyperactivity.

Other studies, some of which have already been mentioned in section 6.1.1 above, have also presented evidence in support of the hypothesis that theory of mind and inhibitory control would predict later hyperactivity. Nevertheless, not all of them have directly tested or considered whether these aspects of cognition would be more strongly predictive of hyperactivity than conduct problems. Firstly, Barkley's (1997) inhibition theory of hyperactivity argues that hyperactivity is caused and maintained by a deficit in the ability to inhibit behaviour, and adhering to such a theory one would predict that poorer performance on IC tasks at age 3 would be associated with corresponding higher levels of hyperactivity at age 4. Hughes et al (1998) selected a sample of "hard to manage" children based on their high levels of hyperactivity (above the population 90th percentile on the SDQ), and found that deficits in IC, as well as impairments on theory of mind tasks, distinguished the group from non-hyperactive children as early as age 4.

Cross-sectional findings in chapter 3 of the present study were consistent with the notion of a pervasive set of cognitive factors being associated with hyperactivity at age 3, at least in the context of the nursery. Non-verbal ability and verbal ability were independently associated with teacher and experimenter-rated hyperactivity, in contrast to the specific verbal association with conduct problems. Furthermore, theory of mind and inhibitory control were significantly negatively associated with teacher- and experimenter-rated (though not parent-rated) hyperactivity. It is predicted therefore, based on previous literature presented above and on the cross-sectional findings of the present study, that all aspects of cognitive functioning measured at age 3 (non-verbal ability, verbal ability, ToM and IC), shall significantly negatively predict hyperactivity at age 4.

The fact that conduct problems and hyperactivity have been shown to show a high degree of co-morbidity (Angold et al, 1999) suggests that we might expect conduct problems at age 3 to be significantly positively associated with hyperactivity at age 4. However, given that all theories attesting to the developmental associations between the two disorders are in the direction of early hyperactivity preceding or predicting later conduct problems (e.g. Patterson et al, 2000; Taylor et al, 1997), it is anticipated that the associations shall not be as strong in magnitude as those between age 3 hyperactivity and age 4 conduct problems. In addition, theories pertaining to the confounding effect of co-morbid conduct problems and hyperactivity in determining cognitive associations, have consistently argued that hyperactivity shows the stronger independent association (Berlin & Bohlin, 2002; Buitelaar et al, 1999; Hinshaw, 1992). For this reason it is not anticipated that controlling for the variance accounted for by time 1 conduct problems will remove a significant proportion of the variance in time 2 hyperactivity explained by any of the cognitive predictors at time 1.

6.1.3 Summary of chapter 6 aims and hypotheses

- Age 3 verbal ability will significantly negatively predict age 4 conduct problems. To a lesser degree, non-verbal ability, ToM and IC at age 3 are also hypothesised to predict age 4 conduct problems. Hyperactivity at age 3 will also be a significant negative predictor of age 4 conduct problems.
- Even when controlling for hyperactivity at age 3, verbal ability at age 3 will still significantly predict conduct problems at age 4. Other aspects of cognition at age 3 (non-verbal ability, ToM and IC) will not emerge as significant predictors of conduct problems at age 4 once the variance accounted for by age 3 hyperactivity is removed.
- NVIQ, verbal ability, ToM and IC at age 3 will significantly negatively predict hyperactivity at age 4.
- Conduct problems at age 3 will be significantly positively associated with hyperactivity at age 4, but to a lesser magnitude than the association between hyperactivity at age 3 and conduct problems at age 4. All 4 measures of cognition at age 3 (NVIQ, Verbal ability, ToM and IC) will continue to significantly negatively predict hyperactivity at age 4 even when controlling for age 3 conduct problems.

6.2 Method

6.2.1 Participants, procedure and measures

Data in this chapter comprise of the entire followed-up sample reported in chapter 4 (N=156), recruited for follow-up using the procedures described in chapter 4. This total follow-up N of 156 refers to the number of children for whom *at least one* aspect of follow-up data was obtained. Thus, individual Ns for different analyses may differ according to variations in the aspects of follow-up data collected. Individual Ns for each analysis are therefore detailed in the tables. All measures at follow-up were the same as used at baseline assessment (see chapter 2 for full description of measures).

6.2.2 Data analysis

Pearson's correlations were calculated between baseline (time 1, age 3) measures of conduct problems (parent and teacher-rated) and follow-up (time 2, age 4) measures of conduct problems. This was to determine the size of the "autocorrelation", i.e. the likelihood that age 3 conduct problems will be positively associated with age 4 conduct problems. Since autocorrelation could account for any potential associations between time 1 cognition and time 2 conduct problems, all subsequent regression analyses controlled for autocorrelation by entering time 1 conduct problems at step 1. For regression equations with parent-rated conduct problems at time 2 as the dependent or outcome variable, time 1 parent-rated conduct problems was entered at step 1 as the autocorrelate variable. With teacher-rated conduct problems at time 2 as an outcome, teacher-rated conduct problems at time 1 was the corresponding autocorrelate variable entered at step 1.

Next, Pearson's correlations between time 2 conduct problems and time 1 cognitive variables (non-verbal IQ, verbal ability, ToM and IC) were calculated, in order to determine which aspects of cognition should be entered as predictors in the regression equations to follow. Alongside these correlations we also calculated the associations between time 1 hyperactivity and time 2 conduct problems.

Following the Pearson's correlations, a series of regression equations were computed in which conduct problems at time 2 were entered as dependent variables. Any significant time 1 cognitive correlates from the preceding correlations were entered as predictors at step 2 after autocorrelation at step 1. If the cognitive predictor was still contributing unique variance to time 2 conduct problems, time 1 hyperactivity was entered at step 2 after autocorrelation, with the cognitive predictor at step 3. If the cognitive predictor accounted for unique variance above and beyond the stability of conduct problems and the co-occurring hyperactivity at age 3, it was considered a significant independent predictor.

Since controlling for autocorrelation was a particularly stringent test of the predictive power of cognition, we decided that the step controlling for time 1 hyperactivity should be more specific than the method used in previous chapters. Whereas in chapters 2 - 5, when controlling for hyperactivity at time 1 we entered all 3 measures of hyperactivity to be cautious, in the present chapter we only entered the measure of hyperactivity that corresponded to the rater of conduct problems at time 2. This was due to the finding that behaviour according to the same rater has consistently shown the greatest stability over time. Thus, if parent-rated conduct problems was the outcome variable, only time 1 parent-rated hyperactivity was entered at step 2.

In a separate regression equation, hyperactivity at time 1 (again, only the rating of hyperactivity that corresponded to the rating of conduct problems at time 2) was subsequently entered as a predictor of conduct problems at time 2, after controlling for autocorrelation of conduct problems at step 1.

All of the above analyses were then repeated with hyperactivity at time 2 (parent, teacher and experimenter-rated) as outcome variables. Thus, autocorrelation was determined by Pearson's correlations between time 1 hyperactivity and time 2 hyperactivity. Next, associations between hyperactivity at time 2 and cognition at time 1 were calculated, followed by associations between hyperactivity at time 2 and conduct problems at time 1. Finally, regression equations were conducted with any significant time 1 cognitive correlates of time 2 hyperactivity entered as predictors, after controlling for autocorrelation of hyperactivity, and then controlling for time 1 conduct problems.

6.3 Results

6.3.1 Age 3 predictors of age 4 conduct problems

Aims and hypotheses: *Age 3 verbal ability, non-verbal IQ, ToM and IC are hypothesised to significantly negatively predict age 4 conduct problems, whilst hyperactivity at age 3 is proposed to significantly positively predict age 4 conduct problems. Verbal ability at age 3 is hypothesised to emerge as the only independent predictor of age 4 conduct problems after taking into account time 1 hyperactivity.*

Table 6.1 details the "autocorrelation" effect, with regard to the associations between time 1 measures of conduct problems and time 2 measures of conduct problems. Associations between ratings of conduct problems by the same rater at the two time points were moderate to large in magnitude (parent-rated conduct problems at time 1 and time 2: r = .59, $p<0.001$; teacher-rated conduct problems at time 1 and time 2: r = .54, $p<0.001$), with between 29% and 35% of variance in common. Associations between different raters at the two time points were still significantly positively associated, thus indicating that regardless of the rater or the context in which the behaviour was rated, having high levels of conduct problems at age 3 was associated with having high levels of conduct problems at age 4. Nevertheless, associations between different raters' ratings of conduct problems at the different time points were weaker in magnitude (parent-rated conduct problems at time 1 and teacher-rated conduct problems at time 2: r = .24, $p<0.05$; teacher-rated conduct problems at time 1 and parent-rated conduct problems at time 2: r = .37, $p<0.001$). Here, only 6 – 14% of variance was shared between different ratings of conduct problems at the 2 time points.

Table 6.1: "Autocorrelation" between time 1 conduct problems and time 2 conduct problems

	Time 2 parent-rated conduct problems	Time 2 teacher-rated conduct problems
Time 1 Parent-rated conduct	.59*** N=108	.24* N=106
Time 1 Teacher-rated conduct	.37*** N=84	.54*** N=84

*p<0.05; ***p<0.001

Table 6.2 shows that the only significant association between cognition at time 1 and conduct problems at time 2 was the negative association between verbal ability at time 1 and parent-rated conduct problems at time 2 (r = .22, p<0.05). Thus, poor verbal ability at age 3 was associated with high levels of conduct problems according to parental ratings at age 4. This association was weak, indicating only 6% of common variance between the two variables. For this reason, verbal ability at time 1 was the only predictor variable entered in the regression equations, and parent-rated hyperactivity at time 2 was the only outcome variable.

Table 6.2: Pearson's correlations between time 1 cognitive variables and time 2 conduct problems

Time 1 variables	Time 2 parent-rated conduct problems	Time 2 teacher-rated conduct problems
Non-verbal IQ	-.03 N=106	-.15 N=102
Verbal ability	-.22* N=105	-.18 N=101
ToM	-.06 N=102	-.12 N=98
IC	-.16 N=102	-.05 N=98

*p<0.05

The positive associations between time 1 hyperactivity and time 2 parent-rated conduct problems ranged from low to moderately large, with all but one reaching statistical significance (see table 6.3; time 1 parent-rated hyperactivity and time 2 parent-rated conduct problems: r = .20, p<0.05; time 1 teacher-rated hyperactivity and time 2 parent-rated conduct problems: r = .21, n.s; time 1 experimenter-rated hyperactivity and time 2 parent-rated conduct problems: r = .25, p<0.05). Stronger associations emerged between time 1 hyperactivity and time 2 teacher-rated conduct problems, one of which (time 1 teacher-rated hyperactivity and time 2 teacher-rated conduct problems) was moderately large in magnitude: Time 1 parent-rated hyperactivity and time 2 teacher-rated conduct problems: r = .34, p<0.001; time 1 teacher-rated hyperactivity and time 2 teacher-rated conduct problems: r = .50, p<0.001; time 1 experimenter-rated hyperactivity and time 2 teacher-rated conduct problems: r = .40, p<0.001. Overall, having high levels of hyperactivity at age 3 was associated with higher levels of conduct problems at age 4, particularly conduct problems occurring in the nursery setting (with between 12 and 25% of variance in common).

Table 6.3: Pearson's correlations between time 1 hyperactivity and time 2 conduct problems

	Time 2 parent-rated conduct problems	Time 2 teacher-rated conduct problems
Time 1 parent-rated hyperactivity	.20* N=108	.34*** N=106
Time 1 teacher-rated hyperactivity	.21 N=84	.50*** N=84
Time 1 experimenter-rated hyperactivity	.25* N=107	.40*** N=105

*p<0.05; ***p<0.001

Once the autocorrelation effect was taken into account (see table 6.4), verbal ability at time 1 did not explain a significant proportion of variance (0%) in time 2 parent-rated conduct problems: Step 1 (parent-rated conduct problems at time 1): R-squared = .34, F (1, 103) = 54.02, Beta = .59, p<0.001; step 2 (verbal ability): R-squared change = .00, F change (2, 102) = 0.60, Beta = -.06, n.s. Thus, any association between time 1 verbal ability and time 2 parent-rated conduct problems only existed because of the fact that verbal ability and conduct problems at time 1 were associated, and individual differences in conduct problems at time 1 were likely to be associated with individual differences in conduct problems at time 2. Above and beyond the stability of conduct problems, verbal ability did not predict conduct problems a year later. Therefore, no further regression equations controlling for the potentially confounding effect of hyperactivity at time 1 were carried out.

Table 6.4: Proportion of variance in time 2 parent-rated conduct problems explained by time 1 verbal ability (Beta, R-squared change), after controlling for autocorrelation

	Time 2 parent-rated conduct problems	
	β	R^2 change
Step1: Time 1 parent conduct	.587***	.344***
Step 2: Time 1 verbal ability	-.064	.004

***p<0.001

Table 6.5 reveals that teacher-rated hyperactivity at time 1 was a significant positive predictor of teacher-rated conduct problems at time 2, independently of the autocorrelation effect (step 1 (time 1 teacher-rated conduct problems): R-squared = .29, $F(1, 82) = 34.12$, Beta = .54, $p<0.001$; step 2 (time 1 teacher-rated hyperactivity): R-squared change = .04, F change $(2, 81) = 20.63$, Beta = .26, $p<0.05$). This illustrates that above and beyond the stability of conduct problems from age 3 to age 4, higher levels of teacher-rated hyperactivity at age 3 tend to predict higher levels of teacher-rated conduct problems at age 4. A further 4% of the variance in time 2 teacher-rated conduct problems was accounted for by time 1 teacher-rated hyperactivity, even after the variance explained by time 1 teacher-rated conduct problems was removed. By contrast, parent-rated hyperactivity at time 1 was not significantly predictive of time 2 parent-rated conduct problems after taking into account autocorrelation, indicating that hyperactivity seems to be a stronger predictor of conduct problems a year later in the nursery rather than the home setting.

Table 6.5: Proportion of variance in time 2 conduct problems explained by time 1 hyperactivity (Beta, R-squared change), after controlling for autocorrelation

	Time 2 parent conduct^		Time 2 teacher conduct^^	
	β	R^2 change	β	R^2 change
Step1:				
Time 1 parent conduct^/	.587***	.344***		
Time 1 teacher conduct^^			.542***	.294***
Step 2:				
Time 1 parent hyp^/	-.030	.001		
Time 1 teacher hyp^^			.263*	.044*

*p<0.05; ***p<0.001; ^Applies to parent-rated conduct problems; ^^Applies to teacher-rated conduct problems

Summary of results: *No significant time 1 cognitive predictors of time 2 conduct problems emerged, contrary to the hypothesis. However, teacher-rated hyperactivity at time 1 was significantly positively predictive of time 2 teacher-rated conduct problems, although parent-rated hyperactivity at time 1 did not significantly predict parent-rated conduct problems at time 2.*

6.3.2 Age 3 predictors of age 4 hyperactivity

Aims and hypotheses: *NVIQ, verbal ability, ToM and IC at age 3 are hypothesised to significantly negatively predict hyperactivity at age 4, independently of conduct problems at age 3.*

Table 6.6 presents the autocorrelation effect for hyperactivity. As reported with regard to the associations between conduct problems at time 1 and time 2, the ratings of hyperactivity at time 1 that corresponded to the same rater or the same context at time 2 were the strongest associations, of a similar moderate magnitude to those reported with regard to conduct problems: Parent-rated hyperactivity at time 1 and time 2: r = .43, p<0.001; teacher-rated hyperactivity at time 1 and time 2: r = .53, p<0.001; experimenter-rated hyperactivity at time 1 and time 2: r = .56, p<0.001; experimenter-rated hyperactivity at time 1 and teacher-rated hyperactivity at time 2: r = .54, p<0.001). All other associations between hyperactivity at time 1 and time 2 were also significantly positively correlated. In general therefore, having high levels of hyperactivity at age 3 was associated with having high levels of hyperactivity at age 4, regardless of the context or rater. Yet hyperactivity was less stable across raters and settings over time, with between 8 and 17% of variance in common between different ratings at time 1 and time 2, in contrast to the 18 – 31% of shared variance between hyperactivity ratings by the same raters over time.

Table 6.6: "Autocorrelation" between time 1 hyperactivity and time 2 hyperactivity

	Time 2 parent-rated hyperactivity	Time 2 teacher-rated hyperactivity	Time 2 exptr-rated hyperactivity
Time 1 parent-rated hyperactivity	.43*** N=108	.41*** N=106	.28*** N=145
Time 1 teacher-rated hyperactivity	.37*** N=84	.53*** N=84	.36*** N=115
Time 1 experimenter-rated hyperactivity	.38*** N=107	.54*** N=105	.56*** N=144

***p<0.001

Table 6.7 shows that, in contrast to the correlation matrix presented with regard to time 2 conduct problems, time 2 hyperactivity was significantly negatively associated with all aspects of cognition at time 1, with 10 of the 12 correlations reaching statistical significance. All significant negative associations were weak to moderate in magnitude (r = between -.2 and -.4), and indicated a general trend for poor cognition at age 3 to be associated with high levels of hyperactivity at age 4. Consequently, since this trend was true of all aspects of time 1 cognition and all ratings of time 2 hyperactivity, all variables were included in the regression equations.

Table 6.7: Pearson's correlations between time 1 cognitive variables and time 2 hyperactivity

Time 1 variables	Time 2 parent-rated hyperactivity	Time 2 teacher-rated hyperactivity	Time 2 exptr-rated hyperactivity
Non-verbal IQ	-.36*** N=106	-.35*** N=102	-.25* N=141
Verbal ability	-.24* N=105	-.39*** N=101	-.27*** N=141
ToM	-.10 N=102	-.26** N=98	-.25** N=136
IC	-.24* N=102	-.18 N=98	-.27*** N=136

*p<0.05, **p<0.01; ***p<0.001

Associations between time 1 conduct problems and time 2 hyperactivity are presented in table 6.8. The correlations were similar in magnitude to the associations between time 1 hyperactivity and time 2 conduct problems, with each rating of time 1 conduct problems significantly positively associated with each rating of time 2 hyperactivity. All associations were weak in magnitude (r = between .22 and .35), corresponding to between 5 and 12% of shared variance between time age 3 conduct problems and age 4 hyperactivity.

Table 6.8: Pearson's correlations between time 1 conduct problems and time 2 hyperactivity

	Time 2 parent-rated hyperactivity	Time 2 teacher-rated hyperactivity	Time 2 experimenter-rated hyperactivity
Time 1 parent-rated conduct problems	.35*** N=108	.27** N=106	.22** N=145
Time 1 teacher-rated conduct problems	.25* N=84	.35*** N=84	.31*** N=115

*p<0.05, **p<0.01; ***p<0.001

Table 6.9 presents the regression equations with all ratings of hyperactivity at age 4 entered (separately) as dependent variables, and NVIQ and verbal ability entered as predictors after the step 1 autocorrelation for the time 1 hyperactivity rating. First of all, NVIQ and verbal ability were entered together at step 2. This step was significant above and beyond the autocorrelation effect for time 2 parent-rated hyperactivity only (step 1 (parent-rated hyperactivity at time 1): R-squared = .19, F (1, 103) = 23.35, Beta = .43, p<0.001; step 2 (non-verbal IQ, verbal ability): R-squared change = .06, Beta = -.24, -.03, p<0.05). Thus, after controlling for the variance accounted for by time 1 parent-rated hyperactivity, a further significant 5.8% of the variance in time 2 parent-rated hyperactivity was independently accounted for by non-verbal IQ and verbal ability at age 3. When non-verbal ability and verbal ability were entered at separate steps, non-verbal ability emerged as the strongest independent predictor, accounting for a further 4% of the variance in time 2 parent-rated hyperactivity even after controlling for both autocorrelation and time 1 verbal ability (step 2 (verbal ability): R –squared change = .02, F change (2, 102) = 2.37, Beta = -.14, n.s; step 2 (non-verbal IQ): R-squared change = .04, F change (3, 101) = 5.28, Beta = -.24, p<0.05). The contribution of time 1 non-verbal IQ and verbal ability to predicting time 2 teacher-rated hyperactivity approached significance, accounting for 5% of the variance over and above autocorrelation, but neither aspect of cognition emerged as significantly predictive of time 2 teacher-rated hyperactivity independently of the other.

Table 6.9: Proportion of variance in time 2 hyperactivity explained by time 1 non-verbal IQ and verbal ability (Beta, R-squared change), after controlling for autocorrelation

	Time 2	P hyp^	Time 2	T hyp^^	Time 2	E hyp^^^
	β	R^2 change	β	R^2 change	β	R^2 change
Step1:						
Time 1 parent^/ teacher^^/ exptr^^^ hyp	.430***	.185***	.531***	.282***	.555***	.308***
Step 2:						
Time 1 NVIQ	-.236*	.058*	-.100	.050†	-.073	.016
Time 1 Verbal	-.031		-.181		-.082	
Step2:						
Time 1 NVIQ	-.251**	.057**	-.177†	.027†	–	–
Step 3:						
Time 1 Verbal	-.031	.001	-.181	.023	–	–
Step 2:						
Time 1 Verbal	-.140	.018	-.223*	.043*	–	–
Step 3:						
Time 1 NVIQ	-.236*	.040*	-.100	.007	–	–

† non-significant trend ($p<0.10$); *$p<0.05$; **$p<0.01$; ***$p<0.001$; ^Applies to parent-rated conduct problems; ^^Applies to teacher-rated conduct problems; ^^^Applies to experimenter-rated conduct problems

The contribution of time 1 non-verbal IQ to predicting time 2 parent-rated hyperactivity was also significant even after controlling for both autocorrelation and time 1 parent-rated conduct problems, accounting for a further independent 5.2% of the variance (see table 6.10): Step 1 (time 1 parent-rated hyperactivity): R-squared = .19, F (1, 104) = 23.57, Beta = .43, $p<0.001$; step 2 (time 1 parent-rated conduct problems): R-squared change = .04, F change (2, 103) = 5.21, Beta = .22, $p<0.05$; step 3 (time 1 NVIQ): R-squared change = .05, F change (3, 102) = 7.27, Beta = -.24, $p<0.01$. Thus, having a poor NVIQ score at age 3 significantly negatively predicted being hyperactive according to parent reports a year later, and this was not due to the fact that hyperactivity at time 1 tended to predict hyperactivity at time 2. Neither was the finding better accounted for by conduct problems at time 1 being significantly associated with both NVIQ at time 1 and hyperactivity at time 2.

Nevertheless this was the only robust cognitive predictor of time 2 hyperactivity, contrary to the prediction that all aspects of cognition would emerge as significant predictors.

Table 6.10: Proportion of variance in time 2 parent-rated hyperactivity explained by time 1 non-verbal IQ (Beta, R-squared change), after controlling for autocorrelation & time 1 conduct problems

	Time 2 Parent-rated hyperactivity	
	β	R^2 change
<u>Step1:</u>		
Time 1 parent-rated hyperactivity	.430***	.185***
<u>Step 2:</u>		
Time 1 parent-rated conduct probs	.215*	.039*
<u>Step 3:</u>		
Time 1 NVIQ	-.238**	.052**

*p<0.05; **p<0.01; ***p<0.001

Finally, table 6.11 indicates that, above and beyond the stability of hyperactivity from age 3 to age 4, ToM did not emerge as a significant predictor of hyperactivity at age 4, explaining only 0.4 to 1.7% of unique variance. IC also failed to independently predict hyperactivity, although the contribution of time 1 IC to the variance in time 2 parent-rated hyperactivity approached significance, accounting for a further 2.8% of the variance over and above autocorrelation (step 1 (time 1 parent-rated hyperactivity): R-squared = .19, F (1, 100) = 22.67, Beta = .43, p<0.001; step 2 (time 1 IC): R-squared change = .03, F change (2, 99) = 3.47, Beta = -.17, p=0.065, n.s.).

Table 6.11: Proportion of variance in time 2 hyperactivity explained by time 1 ToM and IC (Beta, R-squared change), after controlling for autocorrelation

	Time 2 P hyp^		Time 2 T hyp^^		Time 2 E hyp^^^	
	β	R^2 change	β	R^2 change	β	R^2 change
Step1: Time 1 parent^/ teacher^^/ exptr^^^ hyp	.430***	.185***	.531***	.282***	.555***	.308***
Step 2: Time 1 ToM	-.067	.004	-.133	.017	-.111	.012
Step 2: Time 1 IC	-.169†	.028†	-.047	.002	-.098	.008

† non-significant trend ($p<0.10$); ***$p<0.001$ ^Applies to parent-rated conduct problems; ^^Applies to teacher-rated conduct problems; ^^^Applies to experimenter-rated conduct problems

Summary of results: *Almost all aspects of time 1 cognition were significantly negatively associated with almost all ratings of time 2 hyperactivity. However, over and above the stability of hyperactivity, the only significant time 1 cognitive predictor was non-verbal ability in predicting time 2 parent-rated hyperactivity.*

6.4 Discussion

6.4.1 Age 3 predictors of age 4 conduct problems

None of the cognitive measures at age 3 (non-verbal ability, verbal ability, IC, ToM) significantly predicted age 4 conduct problems once the stability of conduct problems from age 3 to age 4 had been accounted for. This was a stringent test of the predictive power of time 1 cognition given that only the direct effects of the variables on later behavioural adjustment and not those mediated by behavioural stability were considered to be indicative of significant predictive associations. As Nigg et al (1999) pointed out, this stringent method of analysis makes any significant results more likely to be consistent with a causal account of the associations between time 1 cognition and time 2 behaviour, although it should be noted that correlations, even those conducted longitudinally such as in the regression equations in this chapter, do not directly imply causality.

The fact that time 1 cognition did not significantly predict time 2 conduct problems once time 1 conduct problems were taken into account does not necessarily demonstrate that cognition has no role to play in the development and maintenance of conduct problems, as many theorists have argued (e.g. Moffitt, 1990; 1993). The autocorrelation was a large effect to override, given that around 29% to 44% of the variance in time 2 conduct problems was accounted for by time 1 conduct problems (denoted by r-squared). It is possible therefore, that in this young sample, the associations between cognition and later conduct problems were simply not independent of the stability of conduct problems and the variance both time 1 cognition and time 2 conduct problems shared with time 1 conduct problems.

The contribution of verbal ability to later antisocial behaviour, independently of the stability of antisocial behaviour, has been demonstrated as early as age 5 in previous studies (Moffitt, 1990). Our data are inconsistent with these reported findings, and are somewhat counter to theories implicating a "cognitive vulnerability" in the development of conduct problems (e.g. Raine, 2002; Nigg & Huang-Pollock, 2003). In the present study we reported that cross-sectionally at age 3 conduct problems were significantly negatively associated with both verbal and non-verbal ability, which also seemed to confirm the notion of lower cognitive functioning in the presence of conduct problems. However, once the shared association with hyperactivity was taken into account, only the association with verbal ability remained significant, and by age 4 no significant associations were evident cross-sectionally between conduct problems and any aspect of cognition. This suggests that not only did cognition at age 3 fail to predict conduct problems a year later, but that the cross-sectional associations present at age 3 were largely due to the fact that many of the children with conduct problems were also hyperactive. Despite some evidence of a small unique association between verbal ability and conduct problems at age 3, such an association was no longer evident by age 4.

Rather than rejecting the concept of an underlying cognitive deficit in conduct problems, our data might indicate that perhaps cognition does not begin to impact upon behaviour until later in development, in line with Rutter et al's (1999) and Nigg and Huang-Pollock's (2003) notion of a delayed mechanism, mediated by environmental experience, by which cognitive or genetic vulnerability results in conduct problems. By this account one could explain the fact that other studies have reported cognitive predictors of conduct problems (e.g. Moffitt, 1990) in that the children in the studies were older than in the present study. Alternatively, perhaps co-morbid hyperactivity accounted for the findings of these other studies as it did in the present study. It is well established that there is a high degree of co-morbidity between conduct problems and hyperactivity (Angold et al, 1999), and many theories implicating numerous cognitive and neuropsychological impairments underlying hyperactivity have been proposed (e.g. Barkley, 1997; Nigg & Huang-Pollock, 2003). Either these deficits directly cause hyperactive behaviour, perhaps by compromising a child's capacity for self-regulation, or the behaviour itself compromises a child's performance on tasks measuring aspects of cognition such that they are not able to concentrate sufficiently on the tasks to perform to the best of their ability. In either case, perhaps these deficits are associated primarily with hyperactivity and have only been reported in children with conduct problems by virtue of the fact that the two behaviour problems often co-occur.

One other account that could be put forward is the possibility that in fact conduct problems cause deficits in cognitive functioning rather than vice-versa, and that this explains why cognition predicts conduct problems in older but not in younger children. This would be consistent with the "IQ is a consequence" account put forward by Goodman et al (1995) as one possible explanation for the association between behaviour problems and IQ. The mechanism by which behaviour might impact upon cognitive ability was suggested to be via interference with learning and performance, although it was also hypothesised that by this process one would expect hyperactivity and IQ to be more strongly associated than conduct problems and IQ. In Goodman et al's (1995) study, a stronger association was found between conduct problems and IQ than hyperactivity and IQ, and this led the authors to conclude that the "IQ is a consequence" account was unsupported by the data. Our findings however are not inconsistent with such an account, and it is thus one worth considering in interpreting the findings from the present chapter. Further longitudinal follow-up assessments would be necessary to test such a hypothesis, which would predict that conduct problems at age 4 would negatively predict cognitive functioning at a later age.

In contrast to the findings regarding the predictive power of time 1 cognition, it emerged that, over and above the influence of time 1 conduct problems and time 1 cognition, teacher-rated hyperactivity at time 1 significantly positively predicted teacher-rated conduct problems at time 2. Time 1 teacher-rated hyperactivity only accounted for a further 4.4% of variance in time 2 teacher-rated conduct problems, but the fact that this was unique variance independent of the large autocorrelation, indicates that the role of hyperactivity in predicting later conduct problems could be an important one.

These results indicate that children rated as hyperactive at age 3 by teachers were likely to show conduct problems at school a year later according to teacher-ratings. Interestingly, parent-rated hyperactivity at time 1 did not predict parent-rated conduct problems at time 2. It has been suggested that early symptoms of hyperactivity may be an earlier manifestation of a disorder which eventually develops into conduct problems (Patterson, DeGarmo & Knutson, 2000), or that conduct problems may be a complication of hyperactivity (Taylor et al, 1997), and these results could reflect such a process. Nevertheless, why the switch from hyperactivity to conduct problems should occur over such a short space of time, and why the progression should only occur according to teachers' ratings of conduct problems, is unclear. Possibly the school or nursery environment would be the first context in which conduct problems might emerge, with its social and academic pressures, and thus perhaps given further follow-up assessments we might have found that hyperactivity predicts conduct problems across contexts.

6.4.2 Age 3 predictors of age 4 hyperactivity

As hypothesised, almost all aspects of cognition at time 1 (non-verbal IQ, verbal ability, ToM and IC) were significantly negatively associated with almost all ratings of hyperactivity at time 2. The associations were all weak in magnitude, but nevertheless the fact that 10 of the 12 correlations reached statistical significance, compared to only one of the correlations between time 1 cognition and time 2 conduct problems, implicates a stronger role for cognition in association with hyperactivity than conduct problems. The autocorrelation effect for hyperactivity was moderate in magnitude, with between 19% and 31% of the variance in time 2 hyperactivity accounted for by time 1 hyperactivity. Thus, overriding this effect to demonstrate the unique variance explained by time 1 cognition was a stringent test.

Despite this stringent test, verbal and non-verbal ability at age 3 significantly negatively predicted parent-rated hyperactivity at age 4, above and beyond the effect of the stability of hyperactivity. Non-verbal ability emerged as the strongest independent predictor, and this aspect of cognition continued to account for a significant proportion of the variance in time 2 parent-rated hyperactivity over and above both the autocorrelation effect and the variance explained by time 1 conduct problems. Although the proportion of unique variance explained by non-verbal IQ was moderately small (5.2%), the finding indicates that non-verbal IQ is a consistent, independent and robust predictor of parent-rated hyperactivity. Verbal ability and non-verbal IQ entered as a step together, also showed a non-significant trend towards explaining unique variance in time 2 teacher-rated hyperactivity over and above the autocorrelation. With 5% of unique variance accounted for by these aspects of cognition, the predictive power was not very different from the 5.8% of variance in parent-rated hyperactivity explained by non-verbal and verbal ability. The fact that the step approached significance even after controlling for autocorrelation, suggests that the data are indicative of an important role for cognition in predicting both parent and teacher-rated hyperactivity. Time 1 non-verbal IQ and verbal ability only contributed a further 1.6% of unique variance to time 2 experimenter-rated hyperactivity over and above autocorrelation, and this independent contribution was not significant. Nevertheless, predicting a one-off episode of hyperactivity during a limited period of time a year later was a somewhat more challenging task for time 1 cognition. Thus perhaps it is not surprising that poor cognition tended to predict hyperactivity more generally, according to raters who were familiar with the children's everyday behaviour.

Above and beyond the contribution of time 1 hyperactivity, ToM and IC at time 1 did not independently contribute to variance in time 2 hyperactivity. There was, however, a non-significant trend towards IC at time 1 predicting parent-rated hyperactivity at time 2. This was a particularly stringent test and therefore does not imply that ToM and IC at age 3 are not associated with age 4 hyperactivity, merely that any association is likely to be mediated by the stability of hyperactivity. Some tentative evidence that IC may have contributed to variance in parent-rated hyperactivity has arisen in the data, although this would need replicating since the strength of association was weak (explaining 2.8% of the variance in parent-rated hyperactivity), and did not reach statistical significance.

The finding that the contribution of ToM and IC to later hyperactivity was not significant is surprising given the literature base attesting to the role of inhibitory control deficits in underlying and predicting hyperactivity (Barkley, 1997; Nigg et al, 1999; Hughes et al, 1998). To a lesser degree, theory of mind has also been found to be associated at least cross-sectionally with hyperactivity (Buitelaar et al, 1999) even as early as age 4 (Hughes et al, 1998). How do we explain the results of the present study which do not concur with previous findings? One explanation is that Barkley's (1997) notion of a deficit in inhibitory control applies only to children at extreme ends of the behavioural distribution with regard to hyperactivity, and thus the fact that the present chapter is concerned with a whole community sample rather than a clinical group of children with ADHD might explain the discordant findings. Alternatively, perhaps hyperactivity leads to impairments in the capacity to mentalise or to inhibit behaviour with time, such that early hyperactivity predicts ToM and IC impairments, rather than vice-versa as implied by the theories of Barkely (1997) and others. Another possibility is that the children in the present sample are simply too young for variations in IC and ToM competency to be measured. Perhaps therefore, an underlying cognitive deficit does exist, as proposed by Rutter et al (1999), but this presents itself in poor non-verbal IQ and verbal ability at this very young age, with deficits in ToM and IC emerging at a later stage. However, the children in Hughes et al's (1998) study were only 4 years old, and whilst the study was not longitudinal and therefore did not imply that IC and ToM deficits predicted later hyperactivity, they did find that cross-sectionally hyperactive children performed significantly more poorly than children who were not hyperactive on tasks measuring the capacity to understand others' behaviours and intentions and the capacity to suppress pre-potent behavioural responses.

Nevertheless, ToM and IC at time 1 were significantly negatively associated with time 2 parent, teacher and experimenter-rated hyperactivity. These aspects of cognition merely failed to explain significant, unique variance in time 2 hyperactivity after controlling for the shared variance with hyperactivity at age 3. These results are consistent with the hypothesis that in the pre-school years, the most important contributor to later hyperactivity seems to be the presence of hyperactivity a year earlier. Whilst there is some evidence that higher levels of hyperactivity are associated with having a poorer capacity to mentalise and to inhibit behaviour a year earlier, these aspects of cognition may not independently impact upon future behaviour until later in development. This could be because these skills are of increasing consequence to a child's life later in development. For example, an impairment in the capacity for inhibitory control might not result in a child at nursery or reception class appearing more hyperactive than their peers. Nevertheless, having to sit still for increasingly prolonged periods of time at school would begin to identify the children with an impaired capacity to inhibit their behaviour. Further, a deficit in the capacity to predict and understand the behaviour and intentions of others, as friendships become increasingly more important, could result in frustration expressed in the form of hyperactivity when children are older.

Despite the fact that IC and ToM at age 3 did not independently predict age 4 hyperactivity, the results of the present chapter offer support for the conjecture that a stronger and more directly influential profile of cognitive impairment characterises children presenting with hyperactivity than children presenting with conduct problems (Rutter et al, 1999; Nigg & Huang-Pollock, 2003). Cognitive functioning in the form of verbal ability and non-verbal IQ at age 3 was more strongly predictive of hyperactivity than of conduct problems a year later, a finding consistent with the notion that a "cognitive vulnerability" (Nigg & Huang-Pollock, 2003) precedes and causes hyperactive behaviour, perhaps via a mechanism like frustration, anger and a sense of failure at academic difficulty (Goodman et al, 1995). Some theorists have postulated that environmental experience mediates the association between early cognitive vulnerability and later conduct problems (e.g. Rutter et al, 1999). Adhering to this theory one would not expect to see a direct causal association, very early in development, between early cognition and later conduct problems. The present findings therefore support such a hypothesis.

Furthermore, we predicted that the association between time 1 conduct problems and time 2 hyperactivity would not be as strong as that between time 1 hyperactivity and time 2 conduct problems. This was based on the conjecture that hyperactivity precedes and perhaps even predicts later conduct problems, whereas the opposite pattern (conduct problems predicting hyperactivity) has not been shown in previous studies (e.g. Patterson et al, 2000). However, in fact associations between conduct problems and hyperactivity were moderate, and in contrast to Patterson et al (2000), the association between time 1 conduct problems and time 2 hyperactivity was similar in magnitude to the association between time 1 hyperactivity and time 2 conduct problems. Despite this, non-verbal IQ still accounted for unique variance in time 2 parent-rated hyperactivity, over and above the variance explained by conduct problems at age 3. This indicates that even though early conduct problems may be associated with hyperactivity a year later, early conduct problems do not account for the cognitive correlates of hyperactivity.

The finding that time 1 cognition predicted time 2 hyperactivity was only applicable to parent and teacher-rated hyperactivity. As discussed previously, it is possible that children were able to curb their hyperactivity levels by the age of 4 for short periods of time, such that experimenters may not have witnessed children's hyperactivity in their "snap-shot" one-off assessment. The experimenter visiting the nursery and spending a short one-to-one session with an individual child, and undertaking several different tasks with them, could have been a particularly engaging and rewarding interaction which held children's attention and concentration for longer than usual even if they were already showing signs of "cognitive vulnerability" or impairment. The nature of observational methods such as the HBRS are such that one would expect some inconsistencies with ratings made with regard to behaviour in general rather than behaviour demonstrated within a one-off window of time. The experimenter-rating will thus not always capture hyperactive behaviour in a hyperactive child, but nonetheless provides an independent evaluation of the child's behaviour which is a useful comparison base for the ratings provided by parents and teachers.

Worthy of comment is the fact that hyperactivity at age 3 predicted conduct problems at age 4, whilst cognitive ability, despite its significant negative association with hyperactivity at age 3, did not. How could hyperactivity predict conduct problems independently of its association with cognitive ability? This is difficult to explain. Perhaps being hyperactive, regardless of whether the behaviour is brought about by an underlying cognitive or genetic deficit, or whether the child is engaging in the behaviour for other reasons: to gain attention perhaps, or to communicate distress or frustration, or merely to mimic the behaviour of other children, would place a child at risk for developing conduct problems later. The idea that genetic or cognitive factors and social or environmental factors could equally lead a child to progress from hyperactivity to conduct problems a year later is consistent with Nigg and Huang-Pollock's (2003) argument that a stronger environmental influence could operate with regard to conduct problems than hyperactivity. Thus, the group of children with conduct problems at age 4 are a mixture of children with cognitive vulnerabilities and children exposed to negative environmental influences, or some combination of the above. Cognition at age 3 alone would therefore not predict conduct problems a year later. Children with hyperactivity at age 4 on the other hand may be more likely to engage in the behaviour as a result of poorer cognitive ability than as a result of negative experiences. Children with both cognitive vulnerability and a difficult environment could present with both hyperactivity and conduct problems and comprise the group of children considered at particularly high risk for poor outcome in terms of engagement in antisocial and criminal behaviour (e.g. Babinski et al, 1999).

6.5 Chapter summary

- No age 3 cognitive predictors of age 4 conduct problems emerged over and above the influence of the stability of conduct problems. Hyperactivity at age 3 emerged as the strongest predictor of conduct problems at age 4, though this was only true of teacher-rated conduct problems.
- In contrast, age 3 verbal and non-verbal ability significantly negatively predicted parent-rated hyperactivity at age 4, over and above the autocorrelation effect and the co-occurrence of conduct problems at age 3. A non-significant trend in the same direction emerged with regard to the independent contribution of non-verbal IQ and verbal ability to time 2 teacher-rated hyperactivity. Further, a non-significant trend was evident with regard to the independent predictive power of time 1 IC to time 2 parent-rated hyperactivity.
- These results support the notion of a stronger and more directly influential cognitive impairment underlying hyperactivity than conduct problems (Nigg & Huang-Pollock, 2003).

7

Gender differences in predictors of conduct problems: Cross-sectional and longitudinal dimensional analyses

7.1 Chapter structure

This chapter aims to determine the extent to which associations between non-verbal and verbal ability and conduct problems, and between hyperactivity and conduct problems, are different for boys and girls. This question shall be addressed with regard to cross-sectional associations at age 3 and at age 4, and with regard to longitudinal associations from age 3 to age 4.

The focus of this chapter is on a reduced set of predictor variables in comparison to the previous chapters, in order to ask more specific questions and to limit the number of analyses employed, thus avoiding spurious type 1 errors. We have chosen to look specifically at non-verbal IQ, verbal ability and hyperactivity as predictors, and to focus on conduct problems as the only outcome. Whilst gender differences in the extent to which cognition predicts hyperactivity is also an important research question, the primary focus of this thesis is predictors of conduct problems.

This chapter will take the following structure. First we shall investigate gender differences in the levels of cognitive and behavioural measures at age 3 to help determine whether boys and girls tend to differ with regard to overall levels of behavioural pathology or cognitive ability. Next, we examine whether there are any gender differences in the strength of associations between non-verbal ability and conduct problems, verbal ability and conduct problems, and hyperactivity and conduct problems cross-sectionally at age 3. Another aim is to contrast these gender differences across dimensional analyses with those found in the categorical analyses at age 3 (chapter 2): Are gender differences amongst children with high levels of conduct problems at age 3 also found across the whole behavioural distribution, or are the gender differences specific to children with extreme levels of conduct problems? Following this section, the same questions shall be addressed cross-sectionally at age 4. Thus, do boys and girls differ with regard to levels of behaviour or cognitive ability at age 4? Do they differ in the strength of association between cognition and conduct problems, or between hyperactivity and conduct problems? Further, do the gender differences correspond to those found in chapter 4 amongst the "at risk" group at age 4? Finally, we examine whether there are gender differences in the strength of association between cognition and hyperactivity at age 3 and conduct problems at age 4. That is to say, are the cognitive and behavioural predictors of conduct problems different for boys and girls?

7.2 Summary of the literature and chapter aims and hypotheses

7.2.1 Gender differences in levels of behaviour and cognitive ability at age 3 and age 4

Before considering the possible differential associations between behaviour and cognitive functioning in boys and girls, it is of interest to determine whether boys and girls differ in terms of their scores in relation to levels of behaviour problems and cognitive functioning in general.

In a nationally representative sample of 5-15 year olds, Maughan, Rowe, Messer, Goodman and Meltzer (2004) reported that diagnoses of CD were significantly more common amongst boys, with the gender difference increasing incrementally with age. However, the children in this sample were older than in the present sample and the study was concerned with clinical diagnoses of conduct disorder or ODD rather than whether individual differences in levels of conduct problems across a non-clinical sample were different for boys and girls. Moffitt et al (2001) examined overall levels of antisocial behaviour problems in the Dunedin Multidisciplinary Study, and found that at almost every age (apart from certain periods in adolescence) boys displayed significantly higher levels of antisocial behaviour, albeit with a small effect size. However, measures of antisocial behaviour were not available for this sample before age 5. Other studies which have looked at younger children have reported that levels of conduct problems are similar in the pre-school years, with clear gender differences emerging after age 4 (Keenan & Shaw, 1994, 1999; Rose et al, 1989). Richman et al (1982) in the Waltham Forest Study, for example, reported that at age 3 there were no gender differences in the degree to which children were reported to be difficult to control or in the susceptibility to temper tantrums. The later gender differences could be due to organic or neurological differences in boys and girls which become apparent after the pre-school period, or alternatively gender-stereotyped expectations and consequent differential socialisation (Fagot & Hagan, 1985). Nevertheless, by the latter account it does not seem likely that such a socialisation process will have had an impact upon levels of behaviour by age 3 or 4.

With regard to hyperactivity, as with conduct problems, a clear male preponderance exists, with an average male-female manifestation of symptoms of 6:1 amongst clinic-referred samples of children (Barkley, 1990), and 3:1 amongst non-referred children (Trites, Dugas, Lynch & Ferguson, 1979). Studies seem to differ in the degree to which pre-school children reportedly display gender differences in levels of hyperactivity. Some studies, for example, found no differences until after age 4 (Rose et al, 1989) whilst others have reported that as early as age 3 boys tend to show higher levels of overactivity and restlessness (Richman et al, 1982). In the present study, our categorical analyses at age 3 (chapter 2) showed that amongst the "at risk" group of children there was some evidence of higher levels of hyperactivity (experimenter-rated) in boys than girls. This indicates that, in line with Richman et al (1982), we might expect to see higher levels of hyperactivity across the whole sample in boys than girls at age 3 and 4.

Gender differences in non-verbal and verbal ability have been reported to be very small, with a slight developmental advantage in females up to the age of 15 due to more rapid maturation in girls (Lynn, 1999). 3-year-old boys in the Waltham Forest Study (Richman et al, 1982) showed more language delay than girls, although the difference was not statistically significant at this young age. Thus, the likelihood of finding gender differences in non-verbal IQ and verbal ability is small in the present study, and it is not anticipated that boys and girls will differ with regard to these aspects of cognition at age 3 or 4.

7.2.2 Gender differences in the strength of association between non-verbal IQ, verbal ability and conduct problems, cross-sectionally at age 3 and age 4

Few studies have investigated gender differences in the associations between cognition and conduct problems across community samples as opposed to clinical samples, and in children as young as 3 and 4 years of age. The two studies in the literature bearing the closest resemblance to the present study, have tended to report a slightly stronger negative association in boys than girls. In the Waltham Forest Study (Richman, Stevenson & Graham, 1982), for example, across the whole sample at age 3 boys with behaviour problems performed significantly worse at verbal comprehension and hand-eye co-ordination than boys without behaviour problems. However, this was not true of girls for whom there were no differences in cognitive ability associated with the presence or absence of behaviour problems. At age 4, boys' performance on the WPPSI scales was poorer in the problem behaviour group than in the control group, whereas girls displayed no such differences. No differentiation between conduct problems and hyperactivity was made in this study, however, and thus we cannot be sure whether the gender differences reflect gender differences in the cognitive correlates of hyperactivity rather than conduct problems.

Plomin et al (2002), on the other hand, did differentiate between conduct problems and hyperactivity in their longitudinal study of a community sample of children at age 2, 3 and 4. They found no differences in the specific associations between cognition and hyperactivity versus cognition and conduct problems, and therefore focussed on a total problems score incorporating both aspects of behaviour. Modest negative associations between behaviour and verbal and non-verbal ability emerged at all ages and for both boys and girls. Associations were stronger for non-verbal than for verbal ability, increased in magnitude for both verbal and non-verbal ability between the ages of 2 and 3, and for verbal ability only between the ages of 3 and 4. For all ages, correlations were slightly (though not significantly) higher for boys than for girls.

Thus far we might anticipate that at age 3 and age 4 a slightly stronger set of negative associations between verbal and non-verbal ability and conduct problems would be apparent for boys than girls. Nevertheless, we know that in both our categorical analyses at age 3 (chapter 2) and dimensional analyses at age 3 (chapter 3), associations between verbal ability and conduct problems were stronger than between non-verbal ability and conduct problems. Further, amongst the "at risk" group, boys and girls did not differ in terms of the extent of verbal deficit associated with their high levels of conduct problems, although there was a non-significant trend in the direction of poorer non-verbal ability amongst "at risk" boys than "at risk" girls. Thus, we might not expect at age 3, to find stronger associations between non-verbal ability and conduct problems than verbal ability and conduct problems (as in Plomin et al's (2002) study) in boys or girls, given our findings across the whole sample. We also may not find, if our categorical findings are replicated in the dimensional analyses here, a stronger association between verbal ability and conduct problems in boys than girls. However, in line with Plomin et al (2002), Richman et al (1982) and our categorical findings in chapter 2, we would expect a stronger association between non-verbal IQ and conduct problems in boys than girls at age 3.

At age 4, gender differences remained of a similar magnitude in both Richman et al's (1982) and Plomin et al's (2002) studies. We know that in general in our sample there was a great deal of instability in associations between cognition and conduct problems between age 3 and age 4, with verbal ability less strongly associated with conduct problems at age 4 than at age 3. Nevertheless, in the categorical analyses gender differences were still in the direction of poorer non-verbal ability amongst "at risk" boys than "at risk" girls, though not independently of hyperactivity. We expect to find therefore continued evidence of a stronger association between non-verbal ability and conduct problems in boys than girls.

Overall, we expect to replicate Plomin et al's (2002) and Richman et al's (1982) findings with regard to a slightly stronger association between cognition and conduct problems in boys. However, on the basis of slight differences in the pattern of results for our particularly high risk sample, we expect that the similarities between the studies will be limited to non-verbal ability.

7.2.3 Gender differences in the strength of association between hyperactivity and conduct problems, cross-sectionally at age 3 and age 4

We hypothesise that hyperactivity and conduct problems will show a stronger positive association for boys than for girls across both time-points. We have reported in chapter 2 that amongst our "at risk" group at age 3, boys displayed significantly higher levels of experimenter-rated hyperactivity than girls, and in chapter 4 when the children were 4 years old, the pattern of results was in the same direction. If at the extreme end of the behavioural distribution there appears to be evidence of a higher co-morbidity between symptom levels of conduct problems and hyperactivity, we might expect to replicate this finding across the whole sample.

There is a strong theoretical rationale for hypothesising that conduct problems may be expected to be more strongly positively associated with levels of hyperactivity in boys than in girls. We know that, in clinical samples, co-morbid symptoms of hyperactivity and conduct problems are associated with particularly severe and enduring antisocial behaviour above and beyond that associated with a profile of conduct problems or hyperactivity alone (Babinski et al, 1999; Lynam, 1996). We also know that boys are more likely than girls to display severe and enduring antisocial behaviour (Moffitt, 1993). One explanation for this latter phenomenon could be, therefore, that boys are more likely than girls to present with this "conduct problems + hyperactivity" profile. Given that the profile is also associated with severe cognitive and neuropsychological deficits (Moffitt & Henry, 1989), this could offer some explanation as to why early-onset conduct problems in boys might be expected to persist.

7.2.4 Gender differences in cross-sectional categorical analyses (chapters 2 and 4) versus gender differences in cross-sectional dimensional analyses (chapter 7)

Plomin et al (2002) reported that gender differences in the strength of association between cognition and behaviour cross-sectionally at ages 2, 3 and 4, did not differ significantly at extreme ends of the distribution with regard to non-verbal and verbal ability from dimensional associations across "individual differences" in cognitive ability. In the present study, although our categorical analyses refer to extreme ends of the *behavioural* distribution rather than extreme ends of the distribution with regard to *cognition*, we hypothesised that in general, gender differences in the categorical analyses would also apply to the dimensional analyses.

This translates to the prediction that non-verbal ability and hyperactivity will emerge across both time points in the dimensional analyses, as more strongly associated with conduct problems for boys than for girls. To support this hypothesis in the dimensional cross-sectional analyses in this study would therefore replicate the categorical findings reported in chapter 2 (at age 3) and chapter 4 (at age 4).

7.2.5 Do non-verbal ability and verbal ability at age 3 differentially predict conduct problems at age 4 in boys versus girls?

We predicted that, cross-sectionally at age 3 and age 4, non-verbal ability would emerge as a stronger negative correlate of conduct problems in boys than in girls. We therefore anticipate that, longitudinally, non-verbal ability at age 3 will emerge as a stronger predictor of conduct problems at age 4 in boys than girls.

In the Dunedin Longitudinal Study, Moffitt et al (2001) reported that boys tended to be exposed to higher rates of neuro-cognitive deficits (including memory, verbal and non-verbal IQ, and reading ability) than girls, and that this difference contributed to the higher rates of antisocial behaviour in boys compared to girls. These findings are somewhat counter to our predictions, since Moffitt et al found that non-verbal ability significantly predicted antisocial behaviour in adolescence to a similar degree for both boys and girls, but that boys were simply more likely than girls to present with poor non-verbal functioning.

Nevertheless, Moffitt et al's study did not collect cognitive measures until the children were 5 years old, and the outcome measure was antisocial behaviour in adolescence, by which time a clear male preponderance was evident. In the present study, a similar proportion of girls and boys presented with conduct problems above the 90th percentile, and thus it seems that at this young age, girls show higher rates of antisocial behaviour than later in development. It is likely therefore that factors predicting antisocial behaviour in 4-year-old girls may differ somewhat to factors predicting antisocial behaviour in adolescent girls.

7.2.6 Does hyperactivity at age 3 differentially predict conduct problems at age 4 in boys versus girls?

In chapter 6 we reported that, across the whole sample, cognitive ability at age 3 was not significantly negatively predictive of conduct problems at age 4. However, hyperactivity at age 3 did emerge as a significant (positive) predictor. It is of interest in the present chapter to determine whether the strength of association between age 3 hyperactivity and age 4 conduct problems differs according to gender. In other words, is hyperactivity a stronger predictor of conduct problems for boys than it is for girls?

Moffitt et al (2001) reported that whilst hyperactivity was predictive of conduct problems for both boys and girls, it was the case that the prediction was stronger for boys and emerged as the most important contributing factor to the gender differences in levels of antisocial behaviour at adolescence. They cited the emerging findings pertaining to a strong genetic influence on hyperactivity (Swanson et al, 2000) as a possible reason for the greater likelihood that boys engage in hyperactive behaviour, indicating a potentially stronger genetic vulnerability in boys. Furthermore, in Richman et al's aforementioned (1982) study, the finding that age 3 "restlessness" was predictive of later behaviour problems was only true of boys, and did not apply to girls. The consensus seems to be therefore that boys are more likely than girls to be hyperactive, and that the effects of hyperactivity on antisocial behaviour are stronger for boys. It is hypothesised therefore that age 3 hyperactivity will be a stronger predictor of age 4 conduct problems for boys than for girls.

7.2.7 Summary of chapter 7 aims and hypotheses

- There will be no significant gender differences with regard to levels of conduct problems or cognitive ability (NVIQ or verbal ability) at age 3 or age 4. At both age 3 and age 4 we hypothesise that boys will present with significantly higher levels of hyperactivity than girls.
- Cross-sectionally at age 3 and age 4, non-verbal ability will be more strongly negatively associated with conduct problems in boys than girls. Hyperactivity will also emerge as significantly more strongly positively associated with conduct problems in boys than in girls at age 3 and age 4.
- Cross-sectional dimensional findings in the present chapter at age 3 and age 4 will be commensurate with cross-sectional categorical findings in chapters 2 and 4.
- Longitudinally, at age 3 both non-verbal ability and hyperactivity will emerge as significantly stronger predictors of age 4 conduct problems in boys than in girls.

7.3 Method

7.3.1 Participants, procedure and measures

Data in this chapter comprise of the entire followed-up sample described in chapter 4 (N=156). All measures are reported in chapter 2.

7.3.2 Data analysis

Mean scores for boys and girls at age 3 and age 4 on the following measures were compared using oneway ANOVAs: Parent and teacher-rated conduct problems, parent, teacher and experimenter-rated hyperactivity, non-verbal IQ, and verbal ability.

Next, we calculated the cross-sectional Pearson's correlations between non-verbal IQ, verbal ability, and hyperactivity at age 3 and conduct problems at age 3 for boys and girls separately. An equivalent set of Pearson's correlations for boys versus girls was then run for the cross-sectional age 4 associations (non-verbal IQ, verbal ability and hyperactivity at age 4 by conduct problems at age 4). Finally, we calculated Pearson's correlations to determine the longitudinal associations in boys compared with girls (non-verbal IQ, verbal ability and hyperactivity at age 3 by conduct problems at age 4). We decided to focus on parent-rated hyperactivity in association with parent-rated conduct problems, and on teacher-rated hyperactivity in association with teacher-rated conduct problems. This was to limit the number of analyses, and to focus on behaviour in the same context, given that these have emerged as the strongest associated ratings of behaviour. Our next step was to determine, using Fisher's r', whether the correlations differed significantly between boys and girls.

One alternative way of analysing the gender differences in the strengths of association between our predictor variables (NVIQ, verbal ability and hyperactivity at time 1 and 2) and our outcome variables (conduct problems at time 1 and time 2) would be the following, a method used in the Dunedin longitudinal study (Moffitt et al, 2001) to investigate gender differences. A gender interaction term denoting gender (coded as 0 and 1) multiplied by the predictor (e.g. NVIQ) is entered alongside both NVIQ and gender, in a single predictive step in a linear regression model. The gender interaction variable should have a significantly high Beta value if a significant difference between boys and girls in the strength of association between NVIQ and conduct problems is evident. We decided not to use this method, since the Beta values for the SPSS-generated "gender interaction" variable were difficult to interpret, given that conduct problems would be represented as increasing as a function of an artificial variable (gender multiplied by non-verbal IQ for example).

In order to be less conservative in these exploratory analyses, we did not control for autocorrelation in the longitudinal correlations, and did not control for the variance explained by non-verbal IQ in analyses in which verbal ability was entered as a predictor, or vice-versa. Conclusions based on these less stringent sets of analyses should consequently be more cautious.

7.4 Results

7.4.1 Oneway ANOVAs examining gender differences in mean levels of behaviour and cognitive ability at age 3 and age 4

Aims and hypotheses: *No significant gender differences in NVIQ or verbal ability at age 3 or 4 are hypothesised to emerge. Parent and teacher-ratings of conduct problems are not expected to be significantly different for boys and girls at either age. However, boys at age 3 and age 4 are expected to present with significantly higher levels of hyperactivity than girls.*

Tables 7.1 and 7.2 present the mean scores on the cognitive and behavioural measures at age 3 and age 4 for boys versus girls. As hypothesised there were no significant gender differences with regard to non-verbal IQ or verbal ability across the two time-points. Both boys and girls presented with mean scores for NVIQ within the population average range at age 3 (boys mean score 92.14, girls 95.44), and scores were two-thirds of a standard deviation higher at age 4 in both boys and girls, in line with our findings for the sample as a whole (boys mean score 101.69, girls 105.28). A similar pattern emerged with regard to verbal ability, which was also within the population average range for both boys and girls at age 3 (boys mean score 94.19, girls 93.83). Higher verbal ability mean scores were evident across gender at age 4, though still within the population average range, and still not significantly different for boys and girls (boys mean score 98.18, girls 100.87).

With regard to levels of conduct problems, at both age 3 and age 4 boys showed a non-significant trend towards displaying higher levels of parent-rated conduct problems than girls. At time 1, the boys' mean score was 2.99, whereas the girls' mean score was 2.47. A modest effect size of 0.26 indicated that the magnitude of difference was small, but approached significance ($F (1, 207) = 3.75$, $p=0.054$). At time 2, parent-rated conduct problems mean scores were lower than at time 1 across gender, though more so for girls (boys' mean score 2.72, girls' mean score 2.00), with a larger effect size of 0.36 indicating a greater magnitude of difference at age 4. The difference still failed to reach statistical significance, however, though did show a non-significant trend ($F (1, 106) = 3.39$, $p= 0.068$, n.s.). Teacher-rated conduct problems on the other hand did not show a significant gender difference at either time point, and showed less variation over time.

At age 3, no significant gender differences emerged with regard to parent and teacher-rated hyperactivity. Nevertheless, there was a significant gender difference with regard to experimenter-rated hyperactivity, with boys showing significantly higher levels than girls ($F (1, 209) = 15.82$, $p<0.001$). The effect size of 0.55 indicated that the magnitude of difference was moderately high. At time 2, results were more consistent with the hypothesis. Both parent- and teacher-rated hyperactivity were significantly higher in boys than girls and a non-significant trend in the same direction emerged with regard to experimenter-rated hyperactivity (parent-rated hyperactivity: $F (1, 106) = 4.80$, $p<0.05$; teacher-rated hyperactivity: $F (1, 105) = 5.50$, $p<0.05$; experimenter-rated hyperactivity: $F (1, 146) = 3.25$, $p=0.074$).

Summary of results: *As hypothesised, no significant gender differences were evident at either time point with regard to performance on tasks measuring non-verbal and verbal ability. Parent-rated conduct problems showed a non-significant trend at both age 3 and age 4 towards being higher for boys than girls. There were no significant gender differences in levels of teacher-rated conduct problems at either time point. At age 3, levels of experimenter-rated hyperactivity were significantly higher in boys than girls, but there were no significant gender differences in levels of parent or teacher-rated hyperactivity. By age 4, levels of parent and teacher-rated hyperactivity were significantly higher in boys than girls, with experimenter-rated hyperactivity showing a non-significant trend in the same direction.*

Table 7.1: Mean scores (SDs) across cognitive and behavioural measures at AGE 3/ TIME 1: Boys versus girls

	Boys	Girls		
	Mean (SD)	Mean (SD)	Effect size	Significant difference?
Non-verbal IQ	92.14 (17.13) N=98	95.44 (17.99) N=110	0.19	n.s.
Verbal ability	94.19 (18.86) N=97	93.83 (18.87) N=108	0.02	n.s.
Parent-rated conduct problems	2.99 (2.01) N=102	2.47 (1.89) N=107	0.26	p=0.054
Teacher-rated conduct problems	1.51 (2.03) N=79	1.38 (1.73) N=92	0.07	n.s.
Parent-rated hyperactivity	3.40 (2.36) N=102	2.90 (2.19) N=107	0.22	n.s.
Teacher-rated hyperactivity	2.95 (2.36) N=79	2.83 (2.24) N=92	0.05	n.s.
Experimenter-rated hyperactivity	12.78 (6.27) N=101	9.79 (3.96) N=110	0.55	***

***p<0.001

Table 7.2: Mean scores (SDs) across cognitive and behavioural measures at AGE 4/ TIME 2: Boys versus girls

	Boys Mean (SD)	Girls Mean (SD)	Effect size	Significant difference?
Non-verbal IQ	101.69 (18.92) N=68	105.28 (19.44) N=80	0.19	n.s.
Verbal ability	98.18 (15.17) N=66	100.87 (16.92) N=78	0.17	n.s.
Parent-rated conduct problems	2.72 (2.34) N=43	2.00 (1.72) N=65	0.36	p=0.068
Teacher-rated conduct problems	1.54 (2.10) N=48	1.54 (2.12) N=59	0	n.s.
Parent-rated hyperactivity	3.40 (2.17) N=43	2.46 (2.17) N=65	0.43	*
Teacher-rated hyperactivity	3.19 (3.17) N=48	1.92 (2.44) N=59	0.45	*
Experimenter-rated hyperactivity	10.34 (5.12) N=68	9.06 (3.44) N=80	0.30	p=0.074

*p<0.05

7.4.2 Gender differences in the cross-sectional associations at age 3 between non-verbal IQ and verbal ability and conduct problems

Aims and hypotheses: *Non-verbal IQ will show a significantly stronger association with conduct problems for boys than for girls. There will be no significant gender differences in the strength of association between verbal ability and conduct problems.*

Table 7.3 presents the correlation coefficients for boys and girls between non-verbal IQ and verbal ability at time 1 and conduct problems at time 1 (top two-thirds of the table). A general trend is evident in the direction of stronger associations for boys than for girls across all variables, and whilst all associations were relatively modest in size, all but one of the correlations were significant for boys but not for girls (e.g. correlation between time 1 NVIQ and time 1 parent-rated conduct problems: boys: $r = -.28$, $p<0.01$; girls $r = -.05$, n.s.). The only significant association for girls was the modest negative association between verbal ability at time 1 and teacher-rated conduct problems at time 1 ($r = -.31$, $p<0.01$), which was comparable to the association between the two variables for boys ($r = -.33$, $p<0.01$). None of the correlations between boys and girls emerged as significantly different from each other according to Fisher's r' statistic.

The strongest difference between boys and girls, though the difference was not statistically significant, was the correlation between non-verbal IQ and parent-rated conduct problems. Figure 7.1 demonstrates this difference pictorially, and illustrates the stronger negative slope for boys. The R-squared values indicate that 7.4%% of the variance in parent-rated conduct problems in boys was accounted for by NVIQ, whereas 0% of the variance in parent-rated conduct problems in girls was accounted for by non-verbal IQ. This gives us some indication of the magnitude of the gender difference, and illustrates that although not significant, there did emerge, if anything, a tendency towards a stronger association between cognition and conduct problems in boys relative to girls.

Table 7.3: Cross-sectional Pearson's correlations between non-verbal IQ, verbal ability and hyperactivity at age 3 and conduct problems at age 3: Boys versus girls

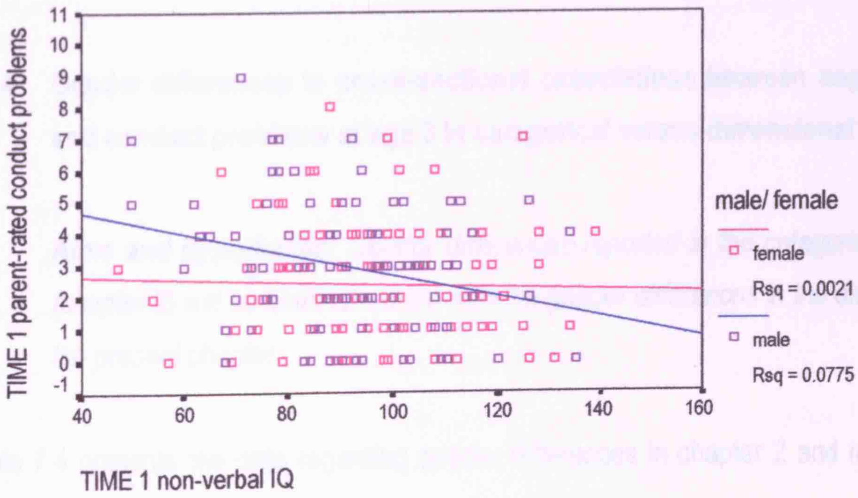
	Boys	Girls
TIME 1 NVIQ x TIME 1 Parent conduct problems	-.28** N=95	-.05 N=104
TIME 1 NVIQ x TIME 1 Teacher conduct problems	-.31** N=74	-.17 N=90
TIME 1 Verbal ability x TIME 1 Parent conduct problems	-.37*** N=94	-.17 N=102
TIME 1 Verbal ability x TIME 1 Teacher conduct problems	-.33** N=72	-.31** N=88
TIME 1 Parent hyperactivity x TIME 1 Parent conduct problems	.36*** N=102	.40*** N=107
TIME 1 Teacher hyperactivity x TIME 1 Teacher conduct problems	.59*** N=79	.63*** N=92

**p<0.01; ***p<0.001

Figure 7.1: Association between time 1 non-verbal IQ

and time 1 parent-rated conduct problems:

Boys versus girls



Summary of results: *Whilst a general trend emerged in the hypothesised direction, with stronger associations between NVIQ and conduct problems (and verbal ability and conduct problems) in boys than girls, the magnitude of the gender differences was not significant.*

7.4.3 Gender differences in the cross-sectional associations at age 3 between hyperactivity and conduct problems

Aims and hypotheses: *Hyperactivity at age 3 will emerge as significantly more strongly positively predictive of conduct problems at age 3 in boys than girls.*

The bottom third of table 7.3 shows that the cross-sectional associations between hyperactivity and conduct problems at age 3 were relatively larger in magnitude than the associations between cognition and conduct problems (reaching as high as $r = -.63$), and moreover that, contrary to the hypothesis, the associations were of a similar magnitude across gender (parent-rated hyperactivity by parent-rated conduct problems: boys $r = .36$, $p<0.001$; girls $r = .40$, $p<0.001$; teacher-rated hyperactivity by teacher-rated conduct problems: boys $r = .59$, $p<0.001$; girls $r = .63$, $p<0.001$). The Fisher's r' statistic confirmed that the associations did not differ significantly between boys and girls.

Summary of results: *Hyperactivity at age 3 was not differentially predictive of conduct problems at age 3 in boys relative to girls.*

7.4.4 Gender differences in cross-sectional associations between cognition, hyperactivity and conduct problems at age 3 in categorical versus dimensional analyses

Aims and hypotheses: *Gender differences reported in the categorical analyses at age 3 (chapter 2) will be commensurate with the gender differences in the dimensional analyses in the present chapter.*

Table 7.4 presents the data regarding gender differences in chapter 2 and in the present chapter side-by-side for direct comparison.

Table 7.4: Gender differences in associations between conduct problems and non-verbal ability, verbal ability, and hyperactivity in categorical versus dimensional analyses at age 3

Measure	Categorical (chapter 2)	Dimensional (chapter 7)	
Non-verbal IQ	Trend	P	x
		T	x
Verbal ability	x	P	x
		T	x
Parent-rated hyperactivity	x	P	x
		T	N/A
Teacher-rated hyperactivity	x	P	N/A
		T	x
Exptr-rated hyperactivity	√	P	x
		T	x

x = No significant mean difference between boys and girls in "at risk" group on measure (categorical) or no significant gender difference in association between conduct problems and measure (dimensional)

√ = Significant mean difference between boys and girls in "at risk" group on measure (categorical) or significant gender difference in association between conduct problems and measure (dimensional)

Trend = Trend towards mean difference between boys and girls in "at risk" group on measure (categorical) or trend towards gender difference in association between conduct problems and measure (dimensional)

The most notable difference in the two sets of results is that in the categorical chapter it emerged that a non-significant trend was evident in the direction of poorer non-verbal IQ in boys with high levels of conduct problems than girls with high levels of conduct problems. In the dimensional chapter however, it was not the case that individual differences in levels of conduct problems across the whole sample were more strongly negatively associated with non-verbal IQ in boys than in girls. This gender difference with regard to non-verbal IQ in the categorical chapter did not reach statistical significance, however, and therefore the results do not necessarily represent highly inconsistent findings.

We predicted on the basis of our findings with regard to higher levels of experimenter-rated hyperactivity in "at risk" boys than "at risk" girls, that in general across the dimensional chapter there would emerge a stronger positive association between hyperactivity and conduct problems in boys than in girls. This prediction was therefore somewhat counter to our conjecture that in general results in the categorical chapter would be replicated in our dimensional chapter, since we did not find in chapter 2 that boys and girls in the "at risk" group differed with regard to parent and teacher rated hyperactivity. Based on the literature and on the general trend towards higher levels of hyperactivity in boys in the categorical analyses, despite the fact that only experimenter-rated hyperactivity reached statistical significance, we expected that the dimensional analyses would, nevertheless, reveal a generally stronger association between hyperactivity and conduct problems in boys than girls.

This hypothesis was not supported. Boys and girls across the sample as a whole did not differ in terms of the strength of association between parent-rated hyperactivity and parent-rated conduct problems, or teacher-rated hyperactivity and teacher-rated conduct problems at age 3.

On the other hand, in the present chapter we did not investigate as a main research question the predictive power of experimenter-rated hyperactivity, since there was no equivalent "experimenter-rated conduct problems" to compare it to. However, we did look at the cross-sectional associations in the whole sample at age 3 between individual differences in experimenter-rated hyperactivity and individual differences in both parent and teacher-rated conduct problems, for boys and girls separately, and found that contrary to the data reported with regard to the "at risk" group, the association was equal in magnitude for boys and girls, with small and non-significant associations between experimenter-rated hyperactivity and parent-rated conduct problems (boys: $r= .15$, n.s; girls: $r= .11$, n.s.), and larger, moderate sized correlations between experimenter-rated hyperactivity and teacher-rated conduct problems (boys: $r= .33$, $p<0.01$; girls: $r= .39$, $p<0.001$).

Our finding that there were no significant differences between boys and girls in the strength of association between parent and teacher-rated hyperactivity and parent and teacher-rated conduct problems, was therefore consistent with our categorical findings, but inconsistent with our prior hypothesis. The finding that experimenter-rated hyperactivity was also not significantly differentially associated with teacher-rated conduct problems in girls versus boys, was contrary to both the categorical findings and our predictions.

Summary of results: *Our finding that no gender differences emerged with regard to the strength of association between non-verbal IQ, verbal ability, parent and teacher-rated hyperactivity, and conduct problems, was largely consistent with our chapter 2 categorical results. The exception to this was the finding in the categorical chapter that a non-significant trend emerged towards "at risk" boys presenting with poorer non-verbal IQs than "at risk" girls. In contrast, dimensional analyses revealed no significant gender differences in the strength of association between non-verbal IQ and conduct problems.*

There emerged some evidence that the gender difference reported in chapter 2 with regard to the higher levels of experimenter-rated hyperactivity in boys relative to girls, was limited to the children with high levels of conduct problems and not replicated across individual differences in levels of behaviour in the larger sample as a whole.

7.4.5 Gender differences in the cross-sectional associations at age 4 between non-verbal IQ and verbal ability and conduct problems

Aims and hypotheses: *Non-verbal ability, but not verbal ability, will show a significantly stronger negative association with conduct problems in boys than girls.*

Table 7.5 details the cross-sectional correlations between age 4 non-verbal IQ and verbal ability, and age 4 conduct problems, for boys and girls separately (top two-thirds of the table). Non-verbal ability showed a trend towards being more strongly negatively associated with conduct problems in boys than girls, consistent with the hypothesis. The association between NVIQ and parent-rated conduct problems was modest for boys, and not quite statistically significant ($r = -.27$, n.s.). Nevertheless, there was almost no association between the two variables for girls ($r = -.01$, n.s.). The association between NVIQ and teacher-rated conduct problems, on the other hand, was stronger in magnitude for both boys and girls, yet still in the direction of a stronger association in boys relative to girls (boys: $r = -.40$, $p<0.01$; girls: $r = -.26$, $p<0.05$).

Correlations between verbal ability and parent-rated conduct problems were modest and not significant, and consistent with the hypothesis, were similar in magnitude for boys and girls (boys: r= -.18, n.s; girls: r= -.15, n.s.). Associations between verbal ability and teacher-rated conduct problems were in the direction of a relatively stronger (though still modest) negative association for girls than boys (boys: r= -.09, n.s; girls: r= -.21, n.s.).

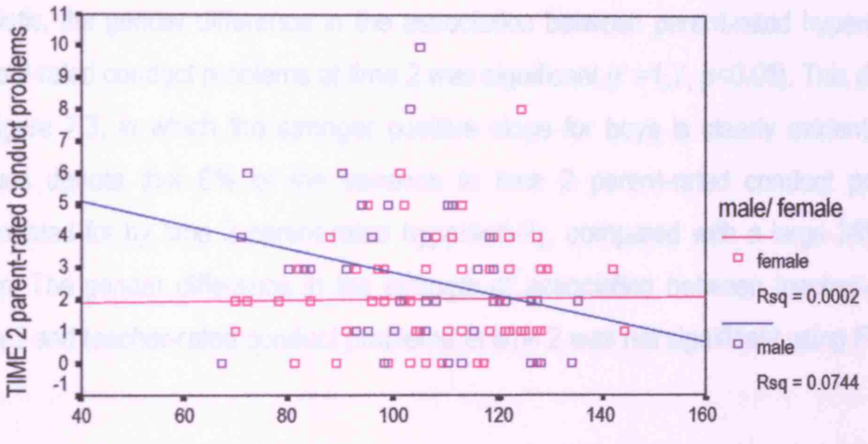
Table 7.5: Cross-sectional Pearson's correlations between non-verbal IQ, verbal ability and hyperactivity at age 4 and conduct problems at age 4: Boys versus girls

	Boys	Girls
TIME 2 NVIQ x TIME 2 Parent conduct problems	-.27 N=40	.01 N=64
TIME 2 NVIQ x TIME 2 Teacher conduct problems	-.40** N=46	-.26* N=57
TIME 2 Verbal ability x TIME 2 Parent conduct problems	-.18 N=38	-.15 N=63
TIME 2 Verbal ability x TIME 2 Teacher conduct problems	-.09 N=45	-.21 N=56
TIME 2 Parent hyperactivity x TIME 2 Parent conduct problems	.62*** N=43	.25* N=56
TIME 2 Teacher hyperactivity x TIME 2 Teacher conduct problems	.61*** N=43	.54*** N=59

*p<0.05; **p<0.01; ***p<0.001

Nevertheless, contrary to the hypothesis, Fisher's r' calculations revealed that no significant gender differences between cognition at time 2 and conduct problems at time 2 were evident. Figure 7.2 displays a scatterplot denoting the strength of association between NVIQ at time 2 and parent-rated conduct problems at time 2. Whilst the difference was not statistically significant, the R squared values illustrate that 7% of the variance in time 2 parent-rated conduct problems was accounted for by time 2 NVIQ for boys, compared with 0% for girls.

Figure 7.2: Association between time 2 non-verbal IQ and time 2 parent-rated conduct problems: Boys versus girls



Summary of results: *Contrary to the hypothesis, there were no significant differences in the strength of association between NVIQ at time 2 and conduct problems at time 2 between boys and girls. Nevertheless, the pattern of results was in the hypothesised direction, with slightly (though not significantly) stronger associations for boys than girls. The finding that there were no significant gender differences in the strength of association between verbal ability at time 2 and conduct problems at time 2. was consistent with our hypothesis.*

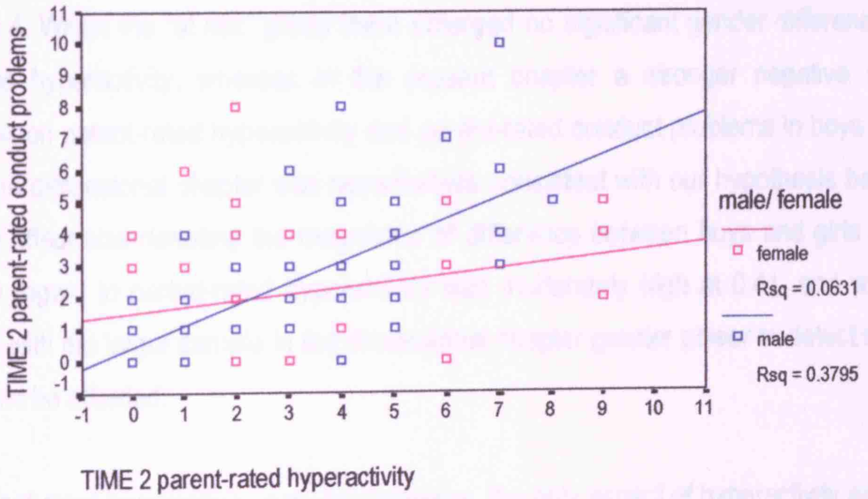
7.4.6 Gender differences in the cross-sectional associations at age 4 between hyperactivity and conduct problems

Aims and hypotheses: *Hyperactivity at age 4 will be more strongly positively predictive of conduct problems at age 4 for boys than for girls.*

Table 7.5 (bottom third of the table) details the separate correlations for boys and girls between hyperactivity at age 4 and conduct problems at age 4. As hypothesised, the positive association between parent-rated hyperactivity and parent-rated conduct problems was stronger in magnitude for boys than for girls, with a relatively large association for boys (r= .62, $p<0.001$) and a modest association for girls (r= .25, $p<0.05$). The gender difference in the association between teacher-rated hyperactivity and teacher-rated conduct problems was still in the direction of a stronger association for boys than for girls, consistent with the hypothesis. Nevertheless, the associations were moderate to large for both boys and girls (boys: r= .61, $p<0.001$; girls: r= .54, $p<0.001$). Using Fisher's r' statistic, the gender difference in the association between parent-rated hyperactivity at time 2 and parent-rated conduct problems at time 2 was significant (r' =1.7, $p<0.05$). This difference is illustrated in figure 7.3, in which the stronger positive slope for boys is clearly evident, and the R squared values denote that 6% of the variance in time 2 parent-rated conduct problems in girls was accounted for by time 2 parent-rated hyperactivity, compared with a large 38% of the variance for boys. The gender difference in the strength of association between teacher-rated hyperactivity at time 2 and teacher-rated conduct problems at time 2 was not significant using Fisher's r' statistic.

Figure 7.3: Association between time 2 parent-rated hyperactivity and time 2 parent-rated conduct problems:

Boys versus girls



Summary of results: *Parent-rated hyperactivity at age 4 was a significantly stronger positive predictor of parent-rated conduct problems at age 4 in boys than in girls, in support of our hypothesis. However, there was no significant gender difference in the extent to which teacher-rated hyperactivity at age 4 predicted teacher-rated conduct problems at age 4.*

7.4.7 Gender differences in cross-sectional associations between cognition, hyperactivity and conduct problems at age 4 in categorical versus dimensional analyses

Aims and hypotheses: *Gender differences reported in the categorical analyses in chapter 4 will be replicated in the dimensional analyses in the present chapter.*

Table 7.6 shows the gender differences found in chapter 4 in contrast to those found in the present chapter. In chapter 4 a non-significant trend emerged towards boys in the "at risk" group at age 4 presenting with poorer non-verbal IQs than girls in the "at risk" group. In contrast, in the present dimensional analyses at age 4, there emerged no significant gender differences in the strength of association between non-verbal IQ and conduct problems. On the other hand, the finding in the present chapter that the association between verbal ability and conduct problems was not significantly different according to gender, was consistent with the categorical findings in chapter 4, in line with predictions. In chapter 4, boys and girls within the "at risk" group did not differ significantly with regard to verbal ability.

A further conflicting finding between the two chapters is with regard to parent-rated hyperactivity at age 4. Within the "at risk" group there emerged no significant gender difference in levels of parent-rated hyperactivity, whereas in the present chapter a stronger negative association emerged between parent-rated hyperactivity and parent-rated conduct problems in boys than girls. This result in the dimensional chapter was nevertheless consistent with our hypothesis based on the literature. The effect size denoting the magnitude of difference between boys and girls in the "at risk" group with regard to parent-rated hyperactivity was moderately high at 0.41, and we therefore expected that with the larger sample in the dimensional chapter greater power to detect significant differences would be afforded.

Parent-rated hyperactivity was, nevertheless, the only aspect of hyperactivity which was differentially associated with conduct problems in boys relative to girls at age 4. Teacher-rated hyperactivity, in line with the categorical findings in chapter 4, was equally highly correlated with teacher-rated conduct problems in boys and girls. Further, though not a central research question in this chapter, we also looked at gender differences in the strength of association between individual differences in experimenter-rated hyperactivity at age 4 and individual differences in parent and teacher-rated hyperactivity at age 4. We found that, consistent with the findings pertaining to the "at risk" group in chapter 4, but contrary to our hypothesis, experimenter-rated hyperactivity was associated with conduct problems to an equivalent magnitude for boys and girls. Thus, as at age 3, weaker and non-significant associations emerged between experimenter-rated hyperactivity and parent-rated conduct problems (boys: r= .26, n.s; girls: r= .10, n.s.), whilst moderate associations emerged between experimenter-rated hyperactivity and teacher-rated conduct problems (boys: r= .43, p<0.01; girls: r= .48, p<0.001).

Table 7.6: Gender differences in associations between conduct problems and non-verbal ability, verbal ability, and hyperactivity in categorical versus dimensional analyses at age 4

Measure	Categorical (chapter 4)	Dimensional (chapter 7)	
Non-verbal IQ	Trend	P	x
		T	x
Verbal ability	x	P	x
		T	x
Parent-rated hyperactivity	x	P	√
		T	N/A
Teacher-rated hyperactivity	x	P	N/A
		T	x
Exptr-rated hyperactivity	x	P	x
		T	x

x = No significant mean difference between boys and girls in "at risk" group on measure (categorical) or no significant gender difference in association between conduct problems and measure (dimensional)

√ = Significant mean difference between boys and girls in "at risk" group on measure (categorical) or significant gender difference in association between conduct problems and measure (dimensional)

Trend = Trend towards mean difference between boys and girls in "at risk" group on measure (categorical) or trend towards gender difference in association between conduct problems and measure (dimensional)

Summary of results: *Results in the two chapters were of mixed comparability. Some similar reported gender differences emerged across chapters (the weak and non-significant association in boys and in girls between verbal ability and conduct problems). Other findings denoted stronger gender differences at extreme ends of the behavioural distribution than across individual differences in the dimensional analyses (tendency for non-verbal IQ and conduct problems to be more strongly negatively associated for boys than girls). Yet other results pertained to stronger gender differences in the whole sample dimensional analyses than in the categorical analyses (parent-rated hyperactivity and parent-rated conduct problems showing a stronger positive association for boys than girls).*

7.4.8 Gender differences in longitudinal associations between non-verbal ability and verbal ability at age 3, and conduct problems at age 4

Aims and hypotheses: *Non-verbal ability at age 3 (but not verbal ability) will be a significantly stronger negative predictor of age 4 conduct problems in boys than girls.*

Table 7.7 shows that, contrary to the hypothesis, associations between non-verbal ability at time 1 and conduct problems at time 2 were similar in magnitude for boys and girls. Associations were marginal between non-verbal IQ at time 1 and parent-rated conduct problems at time 2 across gender (boys: r= .02, n.s; girls: r= -.03, n.s.). Associations were also weak and not significant for boys and girls between time 1 non-verbal IQ and time 2 teacher-rated conduct problems (boys: r= -.18, n.s; girls: r= -.13, n.s.).

In line with our hypothesis, comparable associations between verbal ability at time 1 and parent-rated conduct problems at time 2 emerged between boys and girls, with modest and non-significant associations across gender (boys: r= -.18, n.s; girls: -.24, n.s.). The pattern of results with regard to the association between verbal ability and teacher-rated conduct problems, on the other hand, was in the direction of a stronger association for boys than girls, though associations were still modest in magnitude for both boys and girls and did not reach significance (boys: r= -.27, n.s; girls: r= -.12, n.s.).

Calculating the magnitude of the gender differences using Fisher's r' statistic indicated that none of the associations differed significantly for boys and girls.

Table 7.7: Longitudinal Pearson's correlations between non-verbal IQ, verbal ability and hyperactivity at age 3 and conduct problems at age 4: Boys versus girls

	Boys	Girls
TIME 1 NVIQ x TIME 2 Parent conduct problems	.02 N=42	-.03 N=64
TIME 1 NVIQ x TIME 2 Teacher conduct problems	-.18 N=45	-.13 N=57
TIME 1 Verbal ability x TIME 2 Parent conduct problems	-.18 N=41	-.24 N=64
TIME 1 Verbal ability x TIME 2 Teacher conduct problems	-.27 N=45	-.12 N=56
TIME 1 Parent hyperactivity x TIME 2 Parent conduct problems	.12 N=43	.25* N=65
TIME 1 Teacher hyperactivity x TIME 2 Teacher conduct problems	.42** N=37	.57*** N=47

*p<0.05; **p<0.01; ***p<0.001

Summary of results: *There were no significant gender differences in the degree to which non-verbal ability and verbal ability at age 3 predicted conduct problems at age 4.*

7.4.9 Gender differences in longitudinal associations between hyperactivity at age 3, and conduct problems at age 4

Aims and hypotheses: *Hyperactivity at age 3 will be a significantly stronger positive predictor of age 4 conduct problems in boys than in girls.*

The bottom third of table 7.7 presents the correlation coefficients for boys and girls with regard to the associations between time 1 hyperactivity and time 2 conduct problems. Contrary to the hypothesis, the pattern of results indicates a slightly stronger longitudinal association between hyperactivity at time 1 and conduct problems at time 2 for girls than for boys. The (positive) associations between parent-rated hyperactivity at time 1 and parent-rated conduct problems at time 2 were modest in magnitude across gender, although the association reached statistical significance for girls but not boys (boys: $r= .12$, n.s; girls: $r= .25$, $p<0.05$). Associations were relatively larger in magnitude with regard to teacher-rated hyperactivity at time 1 and teacher-rated conduct problems at time 2 across gender, again in the direction of a stronger association for girls than for boys (boys: $r= .42$, $p<0.01$; girls: $r= .57$, $p<0.001$). Fisher's r' calculations indicated that there were no significant gender differences in the strength of associations between hyperactivity at time 1 and conduct problems at time 2.

Summary of results: *Contrary to the hypothesis, there were no significant gender differences in the extent to which hyperactivity at age 3 predicted conduct problems at age 4.*

7.5 Discussion

7.5.1 Gender differences in levels of behaviour and cognitive ability at age 3 and age 4

As predicted, no significant gender differences emerged with regard to non-verbal ability or verbal ability. These findings are consistent with previous studies, which have indicated no significant gender differences at pre-school age and suggested that gender differences in intellectual functioning do not tend to emerge until after age 4 (Lynn, 1999; Richman et al, 1982; Rose et al, 1989; Keenan & Shaw, 1994; 1999).

One further point to note with regard to cognitive functioning at age 4 is that scores on all cognitive domains increased from age 3 to age 4 for girls and boys alike. Non-verbal ability and verbal ability are standardised scores and hence should not be subject to significant change over time. Possible reasons for this finding were discussed in detail in chapters 4 and 5, with reference to the same pattern of findings in the "high risk" and "low risk" groups, and in the sample as a whole. It is worth acknowledging that this developmental pattern was not carried by one particular gender, and that therefore the phenomenon was truly a general one in this sample, applying to girls and boys, children at extreme ends of the behavioural distribution, and the sample as a whole.

Boys at age 3 and age 4 showed a tendency towards higher levels of parent-rated conduct problems than girls, although this difference did not reach significance. No significant gender differences were in effect with regard to teacher-rated conduct problems. We did not expect to find differences in levels of conduct problems for a number of reasons. We found similar numbers of boys and girls were identified "at risk" in chapter 2 on the basis of their parent and/ or teacher-rated conduct problems. Furthermore, no significant difference between boys and girls in levels of conduct problems has previously been reported in children so young (Keenan & Shaw, 1994, 1999; Rose et al, 1989; Richman et al, 1982), and thus the present findings are consistent with previous literature. In older samples clear differences in levels of conduct problems have been reported, with boys displaying significantly higher levels than girls (Maughan et al, 2004). Thus, with further follow-up assessments of these children we might expect to see boys presenting with higher levels of conduct problems than girls, particularly given that a trend in the same direction was already evident with regard to parent ratings. What might be the explanation for this surge in levels of conduct problems in boys relative to girls with increasing age? Possibly genetic factors which predispose boys to antisocial behaviour manifest at a certain point in maturation, or alternatively environmental influences to which children are exposed as they get older, such as entry to school, trigger antisocial behaviour in children already presenting with cognitive or genetic vulnerabilities. Boys could be more likely than girls to possess a genetic vulnerability or pre-disposition, or could be more likely than girls to be exposed to environmental triggers (e.g. exposure to a deviant peer group), or both.

A marked divergence between boys and girls with regard to levels of parent and teacher-rated hyperactivity from age 3 to age 4 was apparent, with boys displaying significantly higher levels than girls at age 4 despite no gender differences at age 3. Previous studies of pre-schoolers' levels of hyperactivity have produced inconsistent results, some pertaining to no gender differences (Rose et al, 1989) and some reporting higher levels of hyperactivity in boys as early as age 3 (Richman et al, 1982), yet all agreed on the point of increasing divergence between boys and girls with age, in the direction of more hyperactivity in boys than girls. Thus, the findings are consistent with the pattern of gender differences over time reported in previous studies. Experimenter-rated hyperactivity was significantly higher in boys than girls at age 3, and a non-significant trend in the same direction emerged at age 4. Results confirmed our hypothesis: we predicted higher levels of hyperactivity in boys at both time points, and found emerging differences at age 3 which were evident in one of the three ratings, and a clear pervasive difference in levels of hyperactivity in boys relative to girls at age 4.

The present results suggest that if boys do have a stronger genetic pre-disposition towards behaviour problems than girls, hyperactivity is the first to emerge. This is consistent with the notion that the underlying genetic component to hyperactivity manifests itself earlier and more directly than any genetic vulnerability underlying conduct problems (Rutter et al, 1999). By such an account, if we adhere to the hypothesis that boys are more vulnerable than girls, we should expect to see a gender difference in levels of hyperactivity before any such difference in levels of conduct problems emerges.

7.5.2 Gender differences in the cross-sectional associations at age 3 between non-verbal IQ and verbal ability and conduct problems

Boys and girls did not differ significantly in the degree to which non-verbal ability and verbal ability at age 3 predicted concurrent conduct problems at age 3. The finding with regard to verbal ability was consistent with our hypothesis. Boys and girls in the "at risk" group at age 3 (chapter 2) did not differ in terms of verbal ability, and thus poor verbal ability seemed to be associated with conduct problems at the extreme end of the distribution for boys and girls equally. We predicted that we would find a comparable pattern of gender differences with regard to the association between verbal ability and individual differences in levels of conduct problems across the whole sample. It seems that at age 3 in this sample, verbal ability was negatively associated with conduct problems regardless of gender and the severity of the conduct problems. If boys do possess a stronger cognitive vulnerability than girls, that predisposes them to persistent conduct problems (Moffitt et al, 2001), it seems that there are two possible explanations for the present findings. Either the relative cognitive vulnerability in boys is evident later in development (i.e. the girls "catch up" with regard to verbal ability, whereas the boys remain impaired relative to their peers), or the cognitive vulnerability is reflected in areas of cognition other than verbal ability.

Indeed, we proposed that one candidate area of cognition that might be more strongly negatively associated with conduct problems in boys than girls, could be non-verbal IQ. A non-significant trend in the direction of poorer non-verbal IQ emerged in boys relative to girls in the "at risk" group, and hence we proposed that a similar pattern, perhaps stronger in magnitude in the larger sample, would be found across individual differences in conduct problems. Although our findings were in the hypothesised direction, with a tendency towards a stronger association between non-verbal ability and conduct problems in boys relative to girls, this difference did not reach statistical significance. Thus, if non-verbal IQ is more strongly impaired in boys compared with girls presenting with conduct problems, this difference is not large, and may apply more strongly to children with extreme or clinical levels of conduct problems. Our results are therefore consistent with those of Plomin et al (2002), in which associations between behaviour and verbal and non-verbal ability at ages 2, 3 and 4 were not significantly different for boys and girls. As discussed previously, in Plomin et al's study, non-verbal ability was more strongly associated with behaviour than verbal ability across gender, whereas in the present study a stronger association between verbal ability and conduct problems arose at age 3. Thus, results of the two studies were not consistently comparable, but with regard to gender differences at age 3 it seems that our sample followed the pattern found in at least one comparable sample at the same age.

In sum, at age 3, no significant gender differences in levels of conduct problems emerged across the whole sample. Further, a similar proportion of boys and girls were "at risk" for conduct problems, contrary to the male preponderance consistently found in older samples (e.g. Moffitt et al, 2001; Gilmour et al, 2004). Finally, across the sample as a whole at this age, boys and girls did not differ in levels of cognitive ability or in the extent to which verbal and non-verbal ability were negatively associated with individual differences in levels of conduct problems. These findings suggest that perhaps the mechanisms by which boys are more likely to continue to display conduct problems in the future, are not in place at this early age. Social, environmental and perhaps biological or genetic processes which increase the risk for boys, seem to have not yet begun to differentiate boys and girls at age 3. This is perhaps an indication that the pre-school period could be a prime target for intervention initiatives in boys, before they present with a strong risk factor profile that could impede their treatment responsiveness.

7.5.3 Gender differences in the cross-sectional associations at age 3 between hyperactivity and conduct problems

Associations between hyperactivity and conduct problems at age 3 were generally stronger than associations between cognition and conduct problems at age 3, and this was true of both boys and girls to an equal degree. Thus, hyperactivity and conduct problems at age 3 were significantly (and to a moderate to large degree) positively associated for boys and girls alike. Perhaps, therefore, contrary to predictions, the "hyperactivity + conduct problems" profile that has been reportedly associated with a whole host of poor outcomes in comparison to either symptom pattern alone (Moffitt & Henry, 1989; Lynam, 1996), is not in fact more common in boys as early as age 3. We hypothesised that this symptom pattern might explain why boys go on to display significantly more stable and severe antisocial behaviour than girls. This may of course be the case, but as we concluded with regard to cognitive processes, the profile may not characterise boys as early in development as age 3.

We did find in the categorical analyses in chapter 2, that "at risk" boys at age 3 presented with significantly higher levels of hyperactivity than "at risk" girls, but nevertheless, this was only with regard to experimenter-rated hyperactivity. In the present chapter, in order to simplify the analyses and to make the predictor variables more directly comparable to the context in which the conduct problems occurred, we used only parent-rated and teacher-rated hyperactivity as predictors. Thus, in the absence of an experimenter-rated conduct problems outcome measure, experimenter-rated hyperactivity was not included as a predictor variable. Nevertheless, for the purposes of comparing the categorical data in chapter 2 with the dimensional data pertaining to individual differences in levels of behaviour across the whole sample in the present chapter, we did look at gender differences in the association between experimenter-rated hyperactivity and parent and teacher-rated conduct problems. We found, contrary to the categorical findings, that experimenter-rated hyperactivity was equally positively associated with (primarily teacher-rated) conduct problems for boys and girls.

Interestingly, at age 3, the only measure of hyperactivity for which boys and girls differed significantly in terms of overall levels, was experimenter-rated hyperactivity. This seems to be the first context in which gender differences emerge, and with regard to extreme ends of the behavioural continuum, also the first context in which gender differences in associations with conduct problems emerge. Why should it be the case that associations between individual differences in levels of experimenter-rated hyperactivity and individual differences in levels of conduct problems across the whole sample, do not differ significantly for boys and girls, whereas amongst those with particularly high levels of conduct problems, the association does appear to be stronger for boys? Moffitt et al (2001) reported that not only were boys more likely to be *exposed* to hyperactivity than girls, but they were also more *vulnerable* to the risks for conduct problems posed by the presence of hyperactivity. Our study seems to indicate that perhaps it is only when levels of conduct problems are particularly high that the co-occurrence of hyperactivity is likely to be higher in boys than in girls. Thus, perhaps there is something qualitatively different about *high levels* of conduct problems in boys compared with girls, in that it is more likely to be accompanied by high levels of hyperactivity, possibly constituting a qualitatively different disorder (cf. Lynam, 1996). Across individual differences in levels of hyperactivity and conduct problems in the general population, however, it seems that the processes by which hyperactivity and conduct problems are related are generally comparable across gender.

Of course, the above conjecture only applies to experimenter-rated hyperactivity at this particular point. It is difficult to conceive of why the testing situation should be the first in which a male preponderance to hyperactivity amongst "at risk" children arises, since one might contest that one-to-one attention would if anything reduce levels of hyperactivity overall. Perhaps if boys' hyperactivity is more organically rooted (Moffitt et al, 2001), then environmental context will make little difference to the levels of hyperactivity. Girls on the other hand may simply display hyperactivity in stimulating situations such as in large peer groups at nursery, but if placed in a less chaotic environment they may be able to adapt their behaviour accordingly. Thus, we see a gender difference in this context first. If we also concede that some boys may engage in hyperactivity for socially motivated reasons such as mimicking the behaviour of peers, as opposed to an underlying organic impairment, then presumably this sub-set of boys would also be able to refrain from this behaviour during the short testing period. Therefore, the boys with the genetic or organic impairment which is suggested to underlie hyperactivity (Rutter et al, 1999), would also be likely to be the boys who display co-morbid conduct problems. This could explain why the stronger association between age 3 hyperactivity and age 3 conduct problems could be limited to hyperactivity in the testing situation and indeed to very high levels of conduct problems.

It is worth noting that a rater bias on the part of the experimenter is unlikely to account for the stronger gender difference in the categorical analyses. Experimenters were blind to the parent and teacher ratings of conduct problems, since direct child testing tended to take place before questionnaires had been returned from teachers or parents.

7.5.4 Gender differences in the cross-sectional associations at age 4 between non-verbal IQ, verbal ability and conduct problems

Our finding that cognition and conduct problems showed modest to moderate negative associations in boys and girls alike was largely consistent with Plomin et al's (2002) findings. They reported no significant gender differences in the strength of association between non-verbal or verbal ability and conduct problems at either time point, although the pattern of results was in the direction of a stronger association for boys compared with girls, with the magnitude of the gender difference remaining stable across time. Similarly, at both time points in our study a clear tendency emerged towards stronger associations between cognition and conduct problems in boys than girls, despite the fact that the differences did not reach statistical significance.

Our findings, and those of Plomin et al (2002) could indicate that if an underlying cognitive impairment more strongly characterises boys with conduct problems, as theorists such as Moffitt et al (2001) have suggested, perhaps this relative impairment is not yet in place by the pre-school years. Alternatively, it could be that only in clinical populations is a clear gender difference evident in the extent to which conduct problems and cognition are associated, and that only a slight tendency in the same direction is notable with regard to individual differences in levels of conduct problems. This latter account would explain why, in our categorical analyses in chapter 4, a tendency emerged towards poorer non-verbal IQs amongst "at risk" boys than "at risk" girls, in contrast to the lack of significant gender differences between non-verbal IQ and conduct problems in the present dimensional chapter.

7.5.5 Gender differences in the cross-sectional associations at age 4 between hyperactivity and conduct problems

At age 4, not only did boys present with overall higher levels of hyperactivity than girls according to parents and teachers, but hyperactivity according to parent ratings also showed a significantly stronger positive association with parent-rated conduct problems in boys than girls. The former finding could represent a less normative role for hyperactivity by age 4, such that boys begin to engage in the behaviour to a greater degree than girls. The latter finding is consistent with Moffitt et al's (2001) notion that differential exposure and vulnerability to hyperactivity in boys accounts for much of the gender differences in levels of antisocial behaviour later in life. Thus, we may expect that a greater tendency towards co-morbidity of symptoms, given the negative consequences associated with such a symptom profile (e.g. Babinski et al, 1999), could account for the greater prevalence of antisocial behaviour in boys relative to girls later in development. Indeed the gender difference was large in magnitude, indicative of a strong effect. For boys, 38% of the variance in parent-rated conduct problems at age 4 was accounted for by parent-rated conduct problems at age 4, compared to only 6% of the variance for girls.

The above finding is somewhat counter to our reported findings in the "at risk" group at age 4 (chapter 4), whereby levels of parent-rated hyperactivity were not significantly higher in boys relative to girls. Nevertheless, we discussed in chapter 4 the large magnitude of gender difference indicated by the effect size of 0.41, and suspected that given a larger sample size the difference would have been likely to reach a statistically significant level. It is perhaps not surprising that a significant gender difference was evident across the larger sample size across the whole sample in the present dimensional chapter.

What is surprising nonetheless, is the fact that individual differences in levels of teacher-rated hyperactivity at age 4 were not more strongly predictive of individual differences in levels of teacher-rated conduct problems in boys compared to girls. Indeed, in chapter 4 the magnitude of gender difference in the "at risk" group with regard to teacher-rated conduct problems, though not reaching significance, was the strongest of all 3 hyperactivity ratings, with an effect size of 0.52. This discrepancy is difficult to explain.

Also contrary to previous findings is the following pattern of results. At age 3 with regard to experimenter-rated hyperactivity at least, the greater male preponderance towards co-morbid hyperactivity and conduct problems was limited to extreme ends of the behavioural distribution, and not applicable across individual differences in levels of behaviour in the whole sample. At age 4, in contrast, it seems that the stronger association for boys applies to the wider range of behaviour seen across the whole sample to at least an equal degree to the high levels of conduct problems in the "at risk" group. Further, experimenter-rated hyperactivity is no longer differentially associated with conduct problems in boys relative to girls at age 4, and moreover the gender difference is most clear with regard to parent-rated hyperactivity. It is plausible that only amongst children with extreme levels of conduct problems could boys be distinguished from girls in terms of higher levels of hyperactivity as early as age 3. Perhaps as children get older and disruptive behaviour and hyperactivity are considered less "normative" (Campbell, 1995), then gender differences begin to emerge across individual differences in levels of behaviour as well as at extreme ends of the distribution, as girls begin to display less of these externalising behaviours in general. Why the specific aspect of hyperactivity in which gender differences are evident should change between the ages of 3 and 4 is less clear, and perhaps testament to the general instability of the behaviour of pre-schoolers over time.

Despite the reported gender difference in association between hyperactivity and conduct problems at age 4, it is notable that the positive association at both time points was also significant for girls, even though the magnitude of association was not as strong as for boys. Further, as reported at age 3, the association between hyperactivity and conduct problems at age 4, for boys and girls alike, was stronger than the association between cognition and conduct problems at age 4. That is to say that a child's level of hyperactivity, regardless of gender, could in fact be more strongly indicative of a tendency towards conduct problems than their cognitive functioning. This could have important intervention implications, since perhaps controlling levels of hyperactivity (with CBT or psychopharmacological treatments for example) would result in improvements in children's levels of disruptive behaviour and indeed their cognitive functioning.

7.5.6 Gender differences in the longitudinal associations between non-verbal IQ and verbal ability at age 3 and conduct problems at age 4

We hypothesised that since we expected a stronger negative association to emerge between non-verbal IQ and conduct problems in boys compared to girls at age 3, that non-verbal IQ would also be a stronger predictor of age 4 conduct problems in boys relative to girls. However, our predictions were not supported cross-sectionally at age 3, and neither were they supported in the longitudinal analyses.

The finding that non-verbal ability contributes similar variance to later conduct problems in boys and girls is consistent with Moffitt et al's (2001) data from the Dunedin study. Cognitive ability at age 5, which included a measure of non-verbal IQ, was a significant negative predictor of adolescent antisocial behaviour in boys and girls alike, and to an equal degree. Whether our findings would still support Moffitt et al's if we were to follow up our sample a year later remains to be seen. We know that cross-sectionally at age 4, a number of significant gender differences emerged, including a stronger association between non-verbal IQ and conduct problems in boys than in girls. This could indicate that non-verbal ability at age 4 might be likely to emerge as a stronger predictor of age 5 conduct problems in boys than girls. This is purely speculative however, and the present findings illustrate that, in line with findings of older children, non-verbal ability (and verbal ability) at age 3 predicts age 4 conduct problems to a similar degree for boys and girls.

7.5.7 Gender differences in the longitudinal associations between hyperactivity at age 3 and conduct problems at age 4

Our finding that hyperactivity at age 3 was not more strongly predictive of conduct problems at age 4 in boys relative to girls runs counter to a number of previous studies in the literature. Hyperactivity at age 3 has been shown to predict further behaviour problems a year later in boys but not girls (Richman et al, 1982). Another study reported that hyperactivity at age 5 significantly positively predicted antisocial behaviour in adolescence in both boys and girls, but that the association was stronger for boys (Moffitt et al, 2001).

These conflicting findings could be accounted for by the fact that in Richman et al's (1982) study, hyperactivity and conduct problems were not considered separately as outcome measures, but rather a combined "behaviour problems" scale incorporating a mixture of symptoms including both hyperactivity and conduct problems was used. It could be therefore that the stronger association in boys resulted from greater stability in levels of hyperactivity over time in boys than girls. In short, hyperactivity at age 3 may have been a stronger predictor of hyperactivity at age 4 rather than conduct problems at age 4, in boys than girls. Moffitt et al's sample were 2 years older than the present sample at baseline. Since gender differences in the association between hyperactivity and conduct problems, cross-sectionally in our sample, appear to have increased between age 3 and 4, this might indicate that by the time our sample are 5 years old comparable results might be likely to emerge.

In sum, it may be that our sample are too young at age 3 for stronger longitudinal associations to be demonstrable between age 3 hyperactivity and age 4 conduct problems in boys relative to girls. Our findings do not necessarily negate the hypothesis that boys may be more vulnerable to the effects of hyperactivity (Moffitt et al, 2001), and that this could apply equally across individual differences and extreme levels of conduct problems. The pattern of findings could simply reflect that the mechanisms underlying this gender difference do not manifest themselves until later in development.

7.6 Chapter summary

- Boys presented with a non-significant trend towards higher levels of parent-rated conduct problems than girls at age 3 and age 4. Levels of experimenter-rated hyperactivity were significantly higher in boys than in girls at age 3, and by age 4 boys presented with significantly higher levels of parent and teacher-rated hyperactivity than girls, and a non-significant trend in the same direction with regard to experimenter-rated hyperactivity. There were no significant gender differences at age 3 or age 4 in terms of NVIQ or verbal ability.
- Cross-sectionally at age 3 there emerged no significant gender differences in the strength of association between NVIQ, verbal ability or hyperactivity and conduct problems, although there was a tendency, if anything, for associations to be stronger in boys than in girls. For both boys and girls the association between hyperactivity and conduct problems was stronger than the association between cognition and conduct problems.
- Cross-sectionally at age 4 there remained a tendency towards stronger associations between NVIQ and conduct problems in boys than girls, though the gender differences were not significant. Verbal ability and conduct problems were associated to a similar magnitude across gender. Hyperactivity on the other hand was more strongly positively associated with parent-rated conduct problems (though not teacher-rated conduct problems) for boys than girls, although significant positive associations between hyperactivity and conduct problems at age 4 were evident across gender. For both boys and girls, as reported at age 3, the association between hyperactivity and conduct problems was stronger than the association between cognition and conduct problems.
- Longitudinally from age 3 to age 4, the extent to which NVIQ, verbal ability and hyperactivity at age 3 predicted conduct problems at age 4 was equally strong in magnitude for boys and girls alike.
- The extent to which gender differences in the categorical chapters (2 and 4) were replicated across individual differences in levels of behaviour in the present chapter was inconsistent and somewhat difficult to interpret.

8

General discussion

This chapter aims firstly to summarise and consolidate the findings pertaining to the risk factors associated with being "at risk" at age 3 for conduct problems, and to outline a model of early conduct problems. This model shall take into account the stability of conduct problems and risk factors over the course of a year, gender differences in the risk factors associated with early risk, the applicability of the risk factors associated with high levels of conduct problems to individual differences in levels of conduct problems, and the extent to which risk factors apply specifically to conduct problems independently of the influence of co-morbid hyperactivity.

Following the above, we consider the contribution the present study can make to our current understanding about the predictive accuracy of early-identified conduct problems. We review the issues highlighted in the literature as important considerations for studies on early identification, and discuss the extent to which our data support the notion of early identification and intervention for conduct problems. Finally, we outline the limitations of the study, as well as potential clinical implications and future directions for research in this field.

8.1 Towards a model of early conduct problems

The first point to note with regard to the presentation of children at early risk for conduct problems is that in comparison to the population upon which the SDQ was normed, a high proportion of "at risk" children in this sample was identified (approximately 30% above the population 90th percentile). With such a high degree of pathology in this sample it was considered an appropriate sample with which to investigate the risk factors associated with this early presentation of conduct problems.

Three aspects of functioning emerged as strongly impaired in this group relative to the "low risk" group, with the large effect sizes noted in brackets to illustrate the magnitude of difference between the two groups. The "at risk" group presented with significantly poorer verbal ability (.72), poorer social skills (.69 parent-rated, .83 teacher-rated), and higher levels of hyperactivity (.73 parent-rated, .76 teacher-rated, .39 experimenter-rated) than the low-risk children. At this early age, the two groups could not be differentiated in terms of their performance on tasks measuring non-verbal IQ, theory of mind or inhibitory control. The same aspects of functioning also further distinguished a sub-group of children within the "at risk" group with "pervasive" risk for conduct problems (identified by both parent and teacher) from those with "situational" risk (identified by parent or teacher). Verbal ability, social skills and hyperactivity, therefore, emerged as consistently strong associated risk factors amongst 3 year olds with early identified conduct problems, which seemed to show greater impairment as a function of greater behavioural pathology.

Before concluding that impairments across these other areas of functioning might indicate a particularly poor prognosis for these "early risk" children, and advocating early intervention initiatives which target these areas of functioning in order to reduce the profile of risk, we should ask ourselves a number of questions. Firstly, how stable are the early-identified conduct problems over the course of a year, and indeed how stable are the risk factors? If these very early markers for continued conduct problems and the conduct problems themselves are not stable, then perhaps attempts at early identification are not a good use of resources. Secondly, are the risk factors in themselves predictive of poor outcome? In other words, could we measure verbal ability, social skills and levels of hyperactivity in 3-year-old children with early conduct problems, and predict which children would be likely to continue to display conduct problems based on their relatively poorer profile on these "risk factors"?

Thirdly, are these risk factors equally applicable to boys and girls? We know that the prevalence of conduct disorder and antisocial behaviour is substantially more common amongst males than females (e.g. Moffitt et al, 2001). Might gender differences in the profile of risk factors amongst "at risk" boys and girls therefore offer some insight into the mechanisms behind the different developmental trajectories of boys and girls later in development? Fourth, are verbal ability and hyperactivity (since social skills were not considered in these analyses) also associated with individual differences in levels of conduct problems across the whole sample? This would help us determine whether the same processes are associated with more normative variations in levels of conduct problems as those associated with extremely high levels of conduct problems. Finally, is co-morbid hyperactivity responsible for the observed risk factors amongst "at risk" children? For example, might the association between poor verbal ability and early risk for conduct problems only exist by virtue of the high levels of hyperactivity associated with early conduct problems? This would indicate that hyperactivity, rather than conduct problems, is associated with concurrent impairments across other areas of functioning.

8.1.1 Are early conduct problems stable over the course of a year?

We reported that approximately half of the children designated "at risk" at age 3 were still "at risk" a year later. The proportion may have been slightly higher than this given that follow-up data were not obtained for 30% of the group, and the likelihood that the families with the most disruptive and problematic children are those most difficult to recruit to and retain in longitudinal studies (Farrington et al, 1990). It is still not clear whether the "persisters" in terms of continued conduct problems from age 3 to age 4 constitute "true" persisters in the sense of Moffitt's (1993) developmental taxonomy, but certainly there is some evidence that the classification of "risk" for conduct problems at age 3 identified around 50% of children whose behaviour was stable for at least 1 year.

8.1.2 Are the "risk factors" associated with early conduct problems stable over the course of a year?

At age 4 the same risk factors continued to distinguish the "at risk" from the "low risk" group and by a similar magnitude of difference, and in addition the "at risk" group also displayed significantly poorer performance than the "low risk" group with regard to non-verbal IQ. Nevertheless, the stability of these risk factors amongst the "at risk" group was only in terms of their presentation relative to the "low risk" group, yet not relative to the population norms. Thus, although at age 4 the "at risk" group were still functioning significantly more poorly than their 'low risk" peers in terms of verbal ability, social skills and hyperactivity (as well as non-verbal IQ), their level of functioning on these measures was now within the population average range. A more detailed consideration of the possible reasons for this phenomenon is returned to in section 8.1.7. The level of impairment that was evident at age 3, therefore, which appeared to constitute cause for concern about the prognosis for these children, was not nearly as severe a year later. In fact it was now in line with population norms. The risk factors in this sense were, therefore, not stable over the course of a year.

8.1.3 Are the risk factors predictive of persistent conduct problems?

At age 4 the "at risk" group were separated into two categories labelled "persisters" and "desisters", the former of which continued to display conduct problems according to at least one rater, whilst the latter could no longer be classified "at risk". When the risk factor profiles of persisters and desisters a year earlier at age 3, were compared, there emerged no significant differences in the level of impairment across these factors. The risk factors did not significantly distinguish children whose early risk for conduct problems was stable over the course of a year from those whose behaviour improved (at least a little) a year later. In short, poor verbal ability, poor social skills and high levels of hyperactivity at age 3 did not significantly predict persistent conduct problems over the course of a year.

8.1.4 Do the risk factors associated with early risk for conduct problems differ for boys and girls?

At age 3 a number of differences emerged between the risk factor profiles of "at risk" boys and girls, although with these smaller groups (since the "at risk" group was divided in two for these analyses) smaller effect sizes were noted. The data with regard to these gender differences are therefore a more conservative and less conclusive set of findings in comparison with those reported for the "at risk" versus "low risk" group analyses. Nevertheless, the risk factors distinguishing "at risk" boys from "at risk" girls were not the same risk factors that differentiated the "at risk" from the "low risk" group or the "pervasive" from the "situational" group. This indicates that the findings are indicative of a qualitatively different profile for "at risk" boys and girls, rather than a quantitative difference. Were "at risk" boys simply at a more extreme end of the continuum than girls with regard to levels of conduct problems, we would expect the boys to simply present with a poorer profile than the girls with regard to verbal ability, social skills and (particularly parent and teacher-rated) hyperactivity.

In fact, at age 3 "at risk" boys presented with significantly higher levels of experimenter-rated hyperactivity (effect size .67), but not parent and teacher-rated hyperactivity, than the "at risk" girls. In addition, their performance on the Wellman theory of mind tasks measuring early-emerging mentalising abilities, was significantly poorer than that of the "at risk" girls (effect size .53). A non-significant trend in the direction of poorer NVIQ in "at risk" boys relative to "at risk" girls was also apparent (effect size .46). Thus, the extent to which verbal ability, social skills and parent and teacher-rated hyperactivity were impaired in "at risk" children did not differ significantly as a function of gender.

At age 4 the relative impairment in early emerging theory of mind competencies in "at risk" boys compared to "at risk" girls was maintained and of a similar magnitude (effect size .66), as was the trend towards advanced NVIQ in "at risk" girls compared with "at risk" boys (effect size .50). "At risk" girls also began to present with significantly better performance than "at risk" boys on a task measuring inhibitory control. The gender difference with regard to experimenter-rated hyperactivity was no longer evident, but moderate effect sizes denoted some trend towards higher levels of parent and teacher-rated hyperactivity in "at risk" boys relative to "at risk" girls (effect sizes .41 and .52 respectively).

These findings indicate that there may be some overlapping risk factors in boys and girls with early conduct problems (e.g. impaired verbal ability), but that boys also present with a number of additional risk factors which do not characterise "at risk" girls. Possibly the less severe risk factor profile of girls protects them against continued conduct problems later in development, or perhaps there are a set of risk factors not measured in the present study which apply specifically to girls. In either case, it does seem that markers for risk of stable conduct problems should be considered separately for boys and girls.

8.1.5 Do the risk factors associated with high levels of conduct problems also apply to individual differences in levels of conduct problems?

This question was only posed with regard to the cognitive risk factors in the present study. At age 3, the finding that verbal ability was significantly negatively associated with being "at risk" for conduct problems was also found across individual differences in levels of conduct problems across the whole-sample dimensional analyses. Thus, both parent and teacher-rated conduct problems were significantly negatively associated with verbal ability.

At age 4 on the other hand, comparability between the categorical and dimensional analyses was less clear. Non-verbal ability was significantly poorer in the "at risk" group compared with the "low risk" group, and was also significantly negatively associated with individual differences in levels of teacher-rated conduct problems across the whole sample. However, verbal ability was significantly poorer in the "at risk" group relative to the "low risk" group, but was not significantly negatively associated with individual differences in levels of parent or teacher-rated conduct problems. This appears to indicate that perhaps as children get older, associations between behaviour and cognition are stronger at extreme ends of the behavioural distribution than across individual differences in levels of behaviour. Nevertheless, the opposite finding emerged with regard to ToM and IC, which were not significantly poorer in the "at risk" compared with the "low risk" group, but were significantly negatively associated with levels of teacher-rated conduct problems across the whole sample.

In sum, the comparability between the categorical and dimensional analyses was mixed. This could reflect that for some aspects of cognition at some ages, but not for others, associations with conduct problems equally apply to all levels of conduct problems. Alternatively the inconsistent results could simply reflect the different sample sizes being compared in the categorical compared with the dimensional analyses, or the fact that parent and teacher ratings were separately analysed in the dimensional analyses.

Finally, across the whole sample, a similar but weaker pattern of gender differences emerged to the categorical findings amongst the "at risk group. At age 3 and age 4 the pattern of results was generally in the direction of stronger associations between cognition and conduct problems and between hyperactivity and conduct problems in boys than girls, although the only significant difference was between parent-rated hyperactivity and parent-rated conduct problems at age 4.

8.1.6 Is the association between cognitive "risk factors" and conduct problems independent of concurrent hyperactivity?

At age 3, the "at risk" group continued to present with impaired performance with regard to verbal ability relative to the "low risk" group even after controlling for hyperactivity. Similarly, verbal ability at age 3 continued to predict significant variance in individual differences in levels of parent-rated conduct problems even after taking into account the variance explained by hyperactivity.

At age 4, by contrast, the "at risk" group no longer remained significantly impaired with regard to verbal ability or non-verbal IQ in comparison to the "low risk" group after covarying for hyperactivity. Individual differences in levels of non-verbal IQ, ToM and IC also failed to account for significant independent variance in individual differences in levels of conduct problems over and above the variance accounted for by hyperactivity.

At both age 3 and age 4, the reported gender differences within the "at risk" group were also no longer significant after controlling for hyperactivity. This suggests that boys' higher levels of hyperactivity account for their relative impairments in ToM, NVIQ and (at age 4) IC. Because being "at risk" in boys is associated with higher levels of hyperactivity than being "at risk" in girls, a number of additional risk factors not present in "at risk" girls appear to emerge for boys.

It seems therefore that by age 4, Hinshaw's (1992) account of the cognitive impairments associated with conduct problems is supported. Thus, hyperactivity appears to be negatively associated with a pervasive range of cognitive abilities, whereas conduct problems may only appear to be because they tend to co-occur with hyperactivity. Consistent with a number of previous studies on older, clinical samples of children, the cognitive impairments found to be characteristic of children with conduct problems may in fact be carried by co-morbid hyperactivity (e.g. Berlin & Bohlin, 2002; Buitelaar et al, 1999). In addition, this applies across individual differences in levels of hyperactivity and conduct problems as well as amongst children with high or clinically significant levels of conduct problems. The finding that at age 4 different cognitive processes appeared to be associated with high levels of conduct problems to those associated with individual differences in levels of conduct problems, may therefore be inconsequential. All observed associations were in fact carried by hyperactivity and not independently associated with conduct problems.

8.1.7 Model overview and conclusions

Figure 8.1 below outlines the model of early conduct problems derived from the pattern of results discussed above. In essence, the data suggest that of the children categorised at age 3 as presenting with risk for conduct problems, around 50% continued to present with conduct problems a year later. Whilst at age 3 the "at risk" group showed impairment across a range of risk factors in comparison to their "low risk" peers and in comparison to the normal population (notably with regard to verbal ability, social skills and hyperactivity), the functioning of the group on these same risk factors a year later was considerably improved. Further, the risk factors at age 3 were not significant predictors of the stability of conduct problems a year later. By age 4, all associations between conduct problems and risk factors, whether at extreme ends of the behavioural distribution or across individual differences in levels of conduct problems, were due to concurrent hyperactivity which seems to be the strongest behavioural correlate of all aspects of cognition.

Thus, there does seem to be some value in screening at an early age for the presence of conduct problems, since around half of the children identified "at risk" still met criteria for risk a year later. This point shall be discussed in more detail in section 9.2 below. However, this group of at risk 3-year-old children presented with a high degree of variability over time in terms of the extent to which impairments across other areas of functioning tended to co-occur alongside conduct problems. It appears that there is some considerable scope for improvement and resilience in the pre-school years, such that cognitive and behavioural deficits do not seem to be "set" or to be predictive of continued problems. Anecdotally, this phenomenon is commonly witnessed in clinical settings. Particularly amongst very deprived children who have received little or no positive cognitive stimulation at home, integration into the nursery environment has been reported to vastly improve the cognitive profiles of very young children who, on entering nursery, had appeared to present with a very poor and concerning profile (Millar, personal communication, September 2004). Perhaps, therefore, cognitive functioning in the pre-school years may not be such a reliable marker for continued conduct problems as it has been reported to be in older children (Moffitt, 1993).

In terms of gender differences amongst "at risk" children, it is notable that at this young age, in contrast to studies of older children (e.g. Moffitt et al, 2001), boys and girls were equally represented within the "at risk" group. Nevertheless, "at risk" boys presented with a poorer profile of impairment across risk factors than "at risk" girls. They were significantly poorer at understanding the notion of beliefs and desires in others as separate from their own, they were more hyperactive, tended to have poorer non-verbal intelligence, and at age 4 began to show a deficit in the capacity to inhibit a pre-potent response. This relatively poorer presentation could potentially explain why boys go on to show a greater preponderance of life-course persistent antisocial behaviour than girls (Moffitt, 1993). The fact that "at risk" boys tended to be more hyperactive than "at risk" girls seemed to be the driving force behind the relatively poor cognitive profile of "at risk" boys, consistent with the notion of a stronger underlying set of cognitive deficits in hyperactivity than conduct problems (Nigg & Huang-Pollock, 2003).

It could be, therefore, that the propensity towards disruptive and aggressive behaviour is not greater for boys than girls, but that the profile of conduct problems alongside hyperactive behaviour is more likely to prevail amongst boys. The latter behavioural profile has been associated with a host of poor outcomes including adult criminality and personality disorders (Lynam, 1996; Babinski et al, 1999), perhaps by virtue of the associated cognitive impairments characteristic of hyperactivity (Nigg & Huang-Pollock, 2003). One can conceive of how much more likely conduct problems are to persist in the absence of sufficient behavioural control to suppress aggressive behaviour. Further, cognitive impairments, particularly those concerned with the capacity to take into account the perspectives of others, which are associated with hyperactivity (e.g. Buitelaar et al, 1999), may lessen the understanding of the impact of behaviour on others and therefore the motivation to inhibit the behaviour.

Could the fact that boys are more likely than girls to present with the co-morbid profile of conduct problems and hyperactivity, with its concurrent cognitive impairments, indicate a stronger underlying genetic component to the behaviour of boys? Gerhardt (2004) proposed that, contrary to the proponents of the genetic account to explain the early-onset brain impairments of children with hyperactivity or conduct disorder (e.g. Pinker, 2002), that a child's early experiences could lead to different brain responses. Thus, Gerhardt suggested, a neglected or rejected child could have a less well developed pre-frontal cortex due to the lack of a secure relationship which facilitates the growth of the medial prefrontal cortex by generating feel-good opiates in the brain. Skills such as perspective taking and behavioural inhibition are served by this area of the brain, and impairments in these skills have been found to be characteristic of children with hyperactivity (Barkley, 1997).

Gerhardt also argued that neuronal pathways could become etched, through repeated negative experience, into expectations that people will neglect or treat them with hostility. This is consistent with Dodge and Somberg's (1987) theory of skewed social information processing in children with conduct problems, or Happé and Frith's (1996) notion of a "theory of nasty minds". It could be, therefore, that rather being born with a different type of brain to girls, that perhaps boys' brains are simply more vulnerable to the negative effects of a neglectful environment. We know that boys are more susceptible than girls to a number of developmental disorders such as autism and Tourette's syndrome, and are more likely than girls to present with developmental delay and learning difficulties as children. This bio-environmental account could be one way in which boys' greater vulnerability manifests itself in conduct problems and hyperactivity.

8.2 Early identification of risk for conduct problems: A worthwhile endeavour?

Bennett, Lipman, Racine and Offord (1998) outlined 5 characteristics which are necessary in determining the predictive accuracy of early externalising behaviours in predicting later conduct disorder and antisocial behaviour. The first is *sensitivity*, referring to the proportion of individuals with the given outcome (e.g. conduct disorder) in whom the risk was present (e.g. the child was above the population 90th percentile on the SDQ and categorised "at risk"). The second is *specificity*, which is concerned with the proportion of individuals without the outcome (e.g. not developing conduct disorder) in whom the risk was not present (e.g. the child was classified "low risk" at age 3). Positive predictive value is the third characteristic to consider, and pertains to the proportion of those classified "at risk" who develop the outcome. Negative predictive value reflects the proportion of individuals classified "low risk" in whom the outcome is not present. Finally, accuracy refers to the proportion of individuals correctly classified overall.

All of the above factors depend upon the prevalence of the outcome in the population being studied. Thus, for example, the positive predictive value of early externalising problems will be much less in normal populations where the prevalence of conduct disorder and antisocial behaviour is lower, than in clinical populations in which the prevalence is higher. The opposite would be true of the negative predictive value, which increases as a function of lower population prevalence. In other words, it is less likely that an individual will be mis-classified as "low risk" and go on to develop conduct disorder if the likelihood of developing conduct disorder in that particular population is very low.

In a critical review of the available literature on early externalising behaviours in pre-school or first-grade non-referred populations as predictors of later conduct disorder or antisocial behaviour, Bennett et al (1998) reported that overall the predictive accuracy was modest. Positive predictive values for all studies were below 50%, only exceeding this under conditions of very high prevalence. The authors concluded that in any study using the currently available measures of assessment, the presence of early externalising behaviours as a marker of risk in normal populations of kindergarten or first grade children, would produce a high degree of misclassification. This has important implications for the provision of targeted intervention initiatives, which are increasingly being directed at younger children as a preventative measure (Reiss & Price, 1996). If early risk identified in such a way was used as a screen to identify individuals suitable for targeted interventions, at least half of the children who will develop conduct disorder or antisocial behaviour will not be identified and thus not receive an intervention from which they could potentially benefit. Further, half or more of the children in receipt of intervention would have been "false positives", children who were not in fact at risk for later conduct problems, and on whom resources would have been wasted and the negative effects of labelling could create unnecessary problems (Bennett et al, 1998).

Nevertheless, research has shown that as little as 20% of children in need of intervention actually receive it (Institute of Medicine, 1994). This could be due to parents failing to recognise or admit to problems, not knowing where to access help, or a negative perception of services as stigmatising (Pavuluri et al, 1999). Whatever the reason, it is clear that despite the substantial misclassification that is likely from behavioural screens of young children in normal populations, the increase in the number of children potentially in receipt of intervention could be as high as 30% (Bennett et al, 1998). Thus, the authors concluded, there is some value in the early identification of risk for later conduct problems.

How well do our findings fit into the above calculations? It is not possible for us to fully determine the predictive accuracy of our method of identification, since the "outcome" in this study was simply continued conduct problems at age 4, as opposed to a clinical diagnosis of conduct disorder in later childhood or adolescence. Thus, the three children in the "low risk" group at age 3 who went on to meet risk criteria at age 4, might not accurately constitute the negative predictive value in this study. Our tentative finding that approximately half of the children classified "at risk" were still "at risk" a year later seems to be comparable to the above reported findings from previous studies. Our data are therefore consistent with the conjecture that, whilst far from highly accurate, early identification of risk for conduct problems is a potentially beneficial task. As a result, resources can be directed at a greater proportion of needy children than would be accessed by self-referral. The present study supplements the findings summarised by Bennett et al (1998), by reporting that including an assessment of concurrent "risk factors" in 3-year-old children "at risk" for conduct problems does not increase the positive predictive value above and beyond the identification of conduct problems alone.

One cautionary note with regard to the above is that Bennett et al (1998) advocate the use of behavioural screening in normal populations in order to replace universal interventions which they consider a waste of resources, with targeted interventions. However, in our own experience (Millar et al, in preparation), targeted interventions can be perceived as stigmatising, and as such identifying problems in children who would not have received services via the conventional self-referral route would not necessarily result in families taking up the services offered to them. Universal interventions on the other hand can have the advantage of being normalising, to the extent that needy families may be more likely to access them if they feel that they are not being singled out.

Paradoxically therefore, early identification may not, as Bennett et al (1998) suggest, increase take-up of services by as much as 30%, since this figure does not account for families unwilling to accept help. This does not negate the utility of early identification, however. Universal interventions would still benefit from knowing who the needy families are, so that even if services are open to everyone, a special attempt to recruit the families of "at risk" children can be made in the context of a non-stigmatising service. Furthermore, as Webster-Stratton (1993) argued from her substantial clinical experience of running parenting groups for families of children with conduct problems, the inclusion of parents whose children do not present with behaviour problems in groups can be beneficial. She observed that parents of difficult to manage children can benefit from the knowledge that even parents of "normal" children experience problems with parenting, as well as learning from the behavioural management strategies used by competent parents.

8.3 Limitations

The present study, whilst making a valid contribution to the literature in this field, was nonetheless subject to the following limitations which are important and worthy of note. Firstly, no measure of family or social risk was included in the assessment battery. We know that antisocial behaviour tends to continue in the context of environmental adversity (Richman et al, 1982) and that stable conduct problems are best predicted by the presence of multiple risk cutting across child, environment and family domains (Campbell et al, 2000). It has also been reported that the parent-child relationship is one of the most important influences on a child's behaviour (Gerhardt, 2004), be it via the impact of insecure attachment on the capacity to empathise (Bowlby, 1944) or the experience of coercive parenting practices (Patterson, 1982). The fact that child risk factors were considered in isolation in the present study was therefore a significant limitation, given that the context in which these child risk factors were operating and in which the conduct problems were occurring was not known. Our finding that risk factors present alongside early onset conduct problems did not increase the predictive accuracy of the identification of risk could have been due to the fact that we did not consider the multiple and transactional nature of risk factors. Perhaps it would have been possible, in a larger study, to determine whether a combination of different types of risk factors might combine to produce increased risk for stable conduct problems. Thus, as Gerhardt (2004) argues, a child with a genetic vulnerability and propensity towards conduct problems would nevertheless be unlikely to develop significant problems if they were raised in a positive, stimulating and loving environment. Due to limited resources we were unable to include measures of parent-child interaction, or to obtain information about parenting practices, the quality of the marital relationship, or the availability of adequate support networks to the parents. The inclusion of data pertaining to issues such as these would have strengthened the design of the study.

Further limitations surrounded the choice of measures used to assess the child risk factors in the present study. For example, our measure of verbal ability was concerned with receptive vocabulary, and we found, contrary to some of the findings in the literature (e.g. Moffitt, 1990), that verbal ability only distinguished the "at risk" from the "low risk" group, independently of hyperactivity, at age 3. Nevertheless, data arising from more recent research suggest that perhaps pragmatic language, the capacity to use and understand language in context, is the important aspect of verbal ability underlying conduct problems (Gilmour et al 2004). It is possible therefore that our focus on receptive vocabulary could have missed an important aspect of verbal ability which may have shown a more consistent association with early conduct problems.

On a similar vein, our measures of theory of mind may also have failed to capture the essence of the deficit which could be present in children with conduct problems. Hughes et al (1998), for example, reported that their "hard to manage" children performed significantly poorly in relation to control children on tasks measuring the emotional aspect of perspective taking. Thus, the children were significantly impaired in the capacity to predict the character's response to a "nice" compared to a "nasty" surprise, the opposite pattern to the performance of typically developing children. Whilst Hughes et al's hard to manage group were identified on the basis of the presence of high levels of hyperactivity, 80% of the group also presented with conduct problems above the population 90th percentile on the SDQ. The finding is consistent with Happé and Frith's (1996) notion that children with conduct problems present with a "theory of nasty minds". It should be noted that the hard to manage group were also delayed on a false belief task relative to controls, indicating that their theory of mind may have been delayed as well as skewed. Nevertheless, it is unclear the extent to which the delay in theory of mind development could have been due to the high levels of hyperactivity in the hard to manage group, rather than conduct problems per se. Perhaps, therefore, the inclusion of tasks measuring more specifically the potential for a theory of mind skewed towards hostile intent, rather than simply a delay in the capacity to mentalise, would have proved more fruitful in terms of association with conduct problems.

Another limitation of the study is the fact that despite attempting to recruit all families attending the nurseries, the sample was to a large degree self-selecting, such that we managed to recruit approximately 60% of the families to the research project. The possibility that the 40% of families not recruited may have been the most needy 40% of families in the sample (Farrington et al, 1990) cannot be overlooked. Thus, we may have missed a group of more profoundly "at risk" children than those who made up our "at risk" group. Consequently, the potential for this to underestimate the extent of behavioural stability and early risk in the present sample could be significant. We know that a greater proportion of children "in need" as defined by social services, were present in the eligible population as a whole than in the sample recruited. Nevertheless, analysis of the anonymised teacher questionnaires for the unrecruited group compared with the recruited group did not reveal significant differences in the levels of behavioural pathology or social skills of the two groups. Limited resources precluded offering monetary incentives to families for their participation in the project, as in some previous studies (e.g. Loeber et al, 2001), yet our take-up rate of 60% was comparable to other similar studies (e.g. Nigg et al, 1999).

Relatedly, there may also have been some bias in the sample followed-up. Families of children whose problems continued or worsened, or who developed new problems, may have been those families who did not consent to participate at follow-up or who were uncontactable. Our retention rate of 72% was comparable to other similar studies reviewed by Capaldi and Patterson (1987). However, Bennett et al (1998) suggested that a retention rate of at least 80% is necessary in longitudinal studies, and that a lower rate could potentially underestimate the predictive accuracy of risk factors in determining outcome. This is therefore a considerable limitation of the study, but one that was unavoidable due to the limited resources.

Also a potential limitation of the present study was the fact that only a one-year follow-up was conducted. In order to establish the "true" outcome of the children, follow-up assessments into adolescence and adulthood would be necessary, in order to ascertain which individuals developed conduct disorder or antisocial personality disorder, or engaged in criminal activity. We cannot concede that conduct problems which are stable from age 3 to age 4 constitutes persistent antisocial behaviour of the type discussed by Moffitt (1993). Nevertheless, the possibility of conducting further follow-up assessments of this cohort of children in the future is tenable, since at the time of writing the oldest children in the sample are still only 6 years old. This is therefore not necessarily a limitation of this thesis, which could be considered a work in progress.

Another important limitation of this study, which has been alluded to at various points throughout the thesis, is the fact that the "at risk" group were identified via the 90th percentile of the SDQ, which was normed on 5 - to 10-year-olds (Meltzer et al, 2000). In the absence of normative data for 3-year-olds (Goodman, personal communication, August 2002), this was the best metric of risk available to us, and to be cautious we deliberately chose a high cut-off point to reduce as far as possible the likelihood of identifying false positives. However, it is certainly tenable that the cut-offs for 3 year olds, were the data available, would be likely to be somewhat higher than the cut-offs for 5 to 10-year olds. We might expect, for example, that disruptive and aggressive behaviour may be more normative in 3-year-olds and therefore a higher threshold may be necessary to detect levels indicative of risk. Such a possibility could negate our contention that a particularly high level of pathology in terms of conduct problems was evident in our sample (30%) compared to that of the normal population (10%). This issue aside, there is little doubt that at age 3 at least, the "at risk" group presented with a poor profile relative to their peers across a number of areas of functioning, indicating that as a tool for identifying potential risk, the SDQ was a useful and valid measure.

The final limitation also refers to the use of the SDQ. Our measures of conduct problems and hyperactivity were sub-scales derived from the same instrument (the SDQ), which was completed by the same informants on the same occasion. This is a potentially confounding factor because one might contest that the scales may be more likely to be associated with one another than if different instruments were administered, and if they were completed on different occasions. We could therefore have overestimated the association between hyperactivity and conduct problems for this reason. Nevertheless, our use of the experimenter rating of hyperactivity, completed on a different occasion by a different informant, using a different instrument (the HBRS), went some way towards compensating for this. It was thus possible to examine the extent to which results regarding parent and teacher ratings of hyperactivity were corroborated by the experimenter rating. However, without a more clearly separable measure of hyperactivity from conduct problems for parents and teachers, it was difficult to determine the extent to which different results for the experimenter rating compared with parent and teacher ratings reflected true differences in terms of the context of hyperactivity.

8.4 Clinical implications and future directions

Perhaps the most important implication of this longitudinal study is the need for caution in translating findings based on cross-sectional studies of pre-school children into recommendations for policies or clinical interventions. We found that the risk factors associated with conduct problems at age 3 appeared more severe at age 3 than they did at age 4. In general across the whole sample, levels of functioning across all areas of behaviour and cognition improved, and this was also evident amongst the "at risk" group. Indeed, despite the fact that 50% of the "at risk" group continued to display significant conduct problems a year later, the improvements evident across the concurrent risk factors could arguably offer some protection against further conduct problems in the future. The findings are therefore indicative above all else that the behaviour and cognitive functioning of pre-school children, in all likelihood particularly those from deprived populations, are subject to substantial instability over time. Thus, the value of longitudinal studies is highlighted by the present findings.

The notion that early risk for conduct problems in pre-school children may be associated with a more severe profile of impairment across other areas of functioning for boys than girls, possibly due to higher levels of co-morbid hyperactivity, is a new and important finding with numerous implications for clinical practice and future research. For example, the possibility that gender specific interventions could be appropriate for early-onset conduct problems, with a focus for boys on controlling hyperactive behaviour, perhaps with medication, and on extra academic support in school or nursery, could be addressed. Further, longitudinal studies with more follow-up assessment points than in the present study, would benefit from a focus on the extent to which the seemingly less severe risk factor profile for girls acts as a protective factor against future conduct problems, or whether in fact boys tend to "catch up" with girls. In other words, do our findings offer an explanation for the finding that at pre-school levels of conduct problems do not differ for boys and girls, whereas later in development we know that antisocial behaviour is more prevalent amongst males (Moffitt et al, 2001)? The possibility that other, as yet unidentified risk factors may underlie antisocial behaviour in girls should also be addressed in future studies. The fact that antisocial behaviour is of higher prevalence for boys should not preclude further research initiatives which focus on antisocial behaviour in girls. As Farrington (1987) reported, there is some evidence that antisocial behaviour in girls is increasing, and that the level of impairment in terms of levels of comorbid disorders (Robins, 1986) and risk for suicide (Pajer, 1988) is substantially higher amongst the relatively few antisocial women. Further studies which explore the circumstances and risk factors under which girls engage in severe and stable antisocial behaviour throughout the lifespan are therefore much needed.

Our finding that girls at age 3 were equally likely to be classified "at risk" at age 3 for conduct problems as boys, and equally likely to continue to meet criteria for risk a year later, is also a new finding. We interpreted this as reflecting a relatively transient stage of behaviour in girls, based on previous findings pertaining to the lower prevalence of life-course persistent antisocial behaviour in girls than boys (McCabe et al, 2004), and on the fact that the risk factor profiles for girls were somewhat less severe for "at risk" girls than "at risk" boys. Nevertheless, the "at risk" girls were not differentially impaired in comparison to boys on some risk factors, such as verbal ability and social skills. If these are some of the most important impairments associated with antisocial behaviour, as some previous research seems to suggest (Moffitt, 1990; Gilmour et al, 2004), we cannot overlook the possibility that the girls in the present study could be as likely as boys to become "life-course persisters" (Moffitt, 1993). Rutter (2003) attested to the rise in levels of antisocial behaviour in society in recent years. Might our finding reflect this increased prevalence of antisocial behaviour in girls? The sample was drawn from a high-risk population in terms of levels of deprivation. The possibility that in very high risk samples girls may be beginning to show much more similar behavioural profiles to boys across development is one worth investigating. Again, the need for more longitudinal studies is implicated from these tentative observations.

This study offers further evidence for the importance of studying behaviour in different contexts and thus gaining reports from a variety of raters. Many of our findings attested to stronger associations between cognition and behaviour in the school environment, which could have implications for school-based interventions, or for reducing the levels of stimulation and distractions in nursery and school settings which might exacerbate behaviour problems.

We also found evidence for a stronger and more pervasive set of cognitive processes associated with hyperactivity than conduct problems. This was one of the first studies to address this issue in a young, non-clinical sample of children. Further studies attempting to separate the processes underlying these two highly co-morbid aspects of behaviour are therefore warranted, since perhaps interventions focused on alleviating symptoms of hyperactivity could result in improvements in levels of conduct problems. Alternatively, findings attesting to an underlying impairment specific to conduct problems, which is independent of hyperactivity, would enable us to delineate more accurately the potential causal or maintaining processes underlying conduct problems specifically, without the confounding factor of comorbid hyperactivity.

Rutter (2003) argued that the lack of studies investigating bona fide causal processes in the onset and maintenance of antisocial behaviour, as well as effective preventative interventions, is reflected in the paucity of policies implemented on the basis of empirical research. For example, the finding that neglectful child-rearing increases the risk of antisocial behaviour is of little value if we are not clear about how best to prevent neglectful and abusive parenting. Furthermore, Rutter suggested that rather than focusing on antisocial behaviour at the level of the individual (why might one person become antisocial whilst another does not?), studies which focus on overall levels of antisocial behaviour in society might be of greater value in terms of initiating government policy. Thus, the question of why the levels of crime have increased over the last 50 years in spite of the fact that overall living conditions and health have improved, would be an important issue to address.

8.5 Concluding thoughts

How do our findings address the issue of David Blunkett's proposal to target the "criminals of tomorrow" amongst the pre-schoolers of today, discussed at the beginning of this thesis? It seems that Tim Dowling's reservations, evident from the opening quote in chapter 1, were warranted. His point that disruptive behaviour is rife amongst pre-schoolers and that the task of identifying would-be offenders amongst such a behaviourally unstable population would be a hapless task, is to some degree corroborated by the findings from this study.

Nevertheless, the need for preventative interventions and early identification of conduct problems is a pressing clinical issue (Reiss & Price, 1996). If we wait for children to display unquestionable evidence of established and severe antisocial behaviour, then the consensus seems to be that this would be too late to intervene (Kazdin & Wassell, 1999). Early screening for indicators of later conduct problems is by no means a definitive answer: current estimates of the positive predictive value of externalising behaviours in non-clinical populations in predicting antisocial outcome are around 50% (Bennett et al, 1998). However, this is still a substantially higher proportion of children who could potentially benefit from interventions than the estimated 20% of children in need of services who currently receive them (Institute of Medicine, 1994). Thus far, the presentation of high levels of externalising behaviours at an early age is the best indicator we have for identifying potential problems. The present study could not offer conclusive evidence of any concurrent risk factors which could increase the predictive accuracy of early conduct problems.

Despite the limitations of early identification, and our conjecture that David Blunkett's aims were overly ambitious, future research should continue in its endeavour to establish more accurate ways to predict and prevent conduct problems. The following quote encapsulates the need for perseverance in this important but sometimes disheartening field of research:

"In the latter half of the last century, social scientists peddled the wares of supposed solutions to the ills of society. As it became obvious that some of the straightforward, seemingly sensible, suggestions achieved less than was hoped, all of us have become somewhat more cautious. This is appropriate, but it needs to serve as a spur to better research, and not as a disincentive to attempt to make the essential span to policy." (Rutter, 2003).

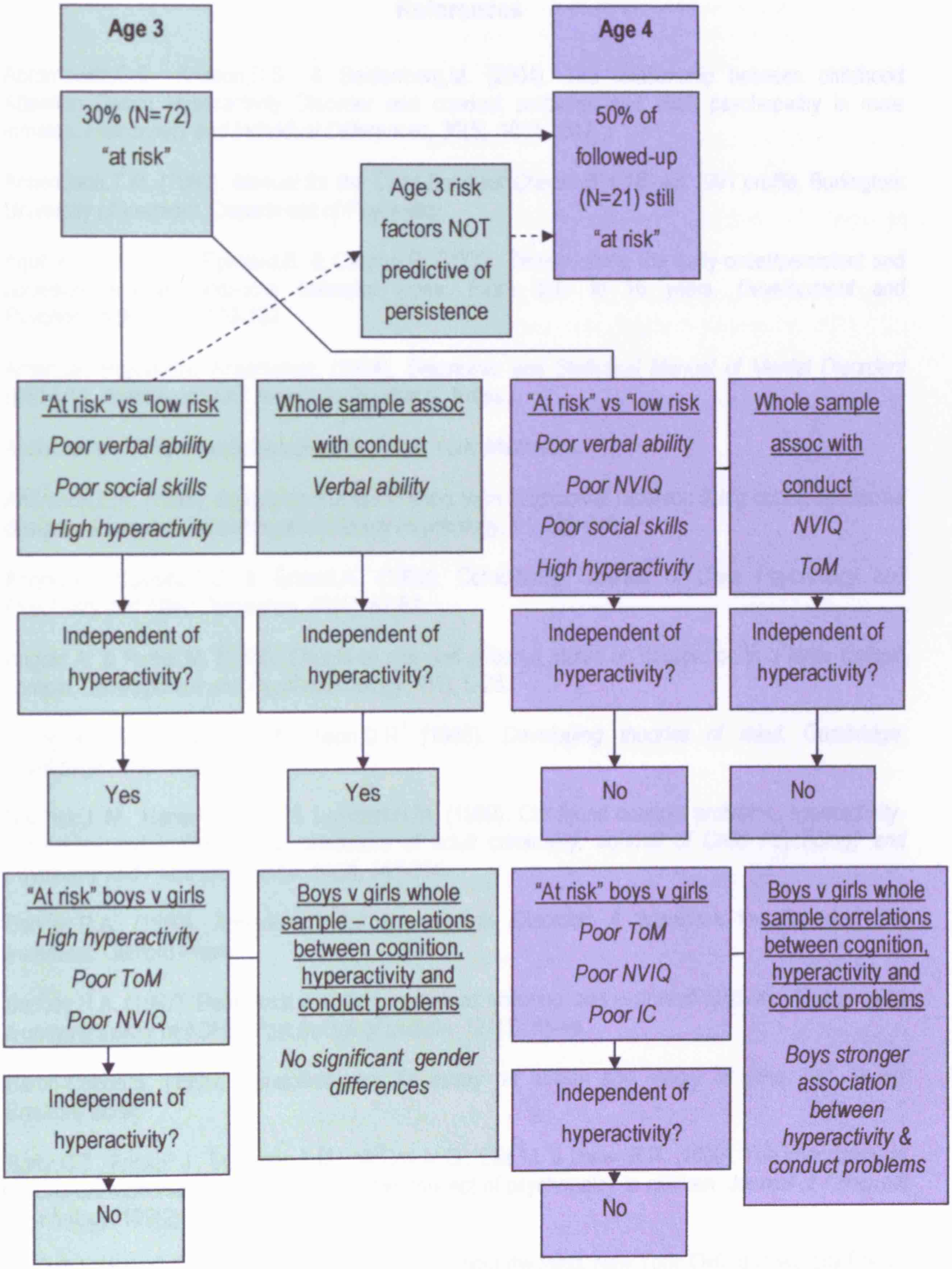


Figure 8.1: Model of early conduct problems

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Appendix A:

Social services "Children in Need" (CIN) Priority Statement

CHILDREN IN NEED (CIN) PRIORITY STATEMENT

Islington Council and Camden and Islington Health Authority consider the following children and young people to be most in need of the services they provide or commission. To indicate which of these applies to the child you are referring, please tick appropriate box(es). Before ticking boxes in (1) below, please see Note 3.

1. Children and young people with a disability. That is a child with one of the following conditions which must be both permanent and substantial:

a visual impairment	☐	(1)
a profound communication impairment	☐	
a physical disability or chronic illness*	☐	
a hearing impairment	☐	
a severe learning difficulty	☐	
a mental illness	☐	

2. Children and young people who are assessed as requiring additional services in order to reach or keep up a reasonable standard of health or development <u>and</u> who are:

children who are or are likely to become "Looked After"	☐	(2)
children subject to Court Orders or Police Powers of Protection	☐	(3)
children who are on the Child Protection Register	☐	(4)
children who have suffered abuse in the past	☐	(5)
children who have a chronic, significant illness*	☐	(6)
children with serious emotional or behavioural difficulties	☐	(7)
children who are siblings of disabled children	☐	(8)
children who are excluded from or who truant from school	☐	(9)
children with severe/complex SEN (this criterion no longer applied to CIN)	☐	(10)
children who are homeless	☐	(11)
children who are privately fostered	☐	(12)
children with drug, alcohol or solvent-related problems	☐	(13)
children who are currently housed in bed and breakfast or hostel accommodation (temporarily housed)	☐	(14)
children who are unaccompanied refugees or asylum seekers	☐	(15)
children whose parents [or primary carers] have a significant physical or mental illness or physical or learning disability*	☐	(16)
children whose parents [or primary carers] are experiencing difficulty as a result of drug or alcohol-related problems	☐	(17)
children living with domestic violence	☐	(18)

* Children infected or affected by HIV will be deemed to be 'in need' within one of these three categories

Appendix B:

Parent-completed questionnaires

1) Today's date..

2) Name of parent..

3) Parent's date of birth..

4) Name of child..

5) Child's date of birth..

6) Name of nursery..

7) Name of child's keyworker..

8) Home address

....

....

....

....

9) Home telephone number..

10) Mobile ....

11) Email ....

12) Ethnic origin

White	Black Caribbean	Black African	Other Black	Indian	Pakistani	Bangladeshi	Chinese	Other Asian	Other
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

13) Is English your first language?

Yes	No
☐	☐

14) If no, please indicate which is your first language..

15) Name of GP..

16) Address of GP

....

....

....

17) Do you have employment outside the home? Yes ☐ No ☐

18) If yes, what is the nature of your work?..

19) Do you have a partner that lives with you? Yes ☐ No ☐

20) If yes, do they have employment outside the home? Yes ☐ No ☐

21) If yes, what is the nature of their work?..

22) Are there any other children living in the home? Yes ☐ No ☐

23) If yes, please list their names and dates of birth and/or ages

....

....

....

....

24) Please indicate the furthest level of education you attended:

up to age 16	GCSEs	GNVQ, A level / equivalent	Further Education
☐	☐	☐	☐

25) If you have a partner who lives with you, please indicate the furthest level of education they attended:

up to age 16	GCSEs	GNVQ, A level / equivalent	Further Education
☐	☐	☐	☐

26) In the last 6 months, have you or your child had contact with any of the following? (Tick as many as apply)

Social Worker	GP	Health Visitor	Speech/ Language Therapist	Counsellor	Clinical Psychologist	Educational Psychologist
☐	☐	☐	☐	☐	☐	☐

27) If yes, please specify the nature of the contact

....

....

Strengths and Difficulties Questionnaire

P3/4

For each item, please mark the box for Not True, Somewhat True or Certainly True. It would help us if you answered all items as best you can even if you are not absolutely certain or the item seems daft! Please give your answers on the basis of the child's behaviour over the last six months

Child's Name .... **Male/Female**

Date of Birth ....

	Not True	Somewhat True	Certainly True
Considerate of other people's feelings	☐	☐	☐
Restless, overactive, cannot stay still for long	☐	☐	☐
Often complains of headaches, stomach-aches or sickness	☐	☐	☐
Shares readily with other children (treats, toys, pencils etc.)	☐	☐	☐
Often has temper tantrums or hot tempers	☐	☐	☐
Rather solitary, tends to play alone	☐	☐	☐
Generally obedient, usually does what adults request	☐	☐	☐
Many worries, often seems worried	☐	☐	☐
Helpful if someone is hurt, upset or feeling ill	☐	☐	☐
Constantly fidgeting or squirming	☐	☐	☐
Has at least one good friend	☐	☐	☐
Often fights with other children or bullies them	☐	☐	☐
Often unhappy, down-hearted or tearful	☐	☐	☐
Generally liked by other children	☐	☐	☐
Easily distracted, concentration wanders	☐	☐	☐
Nervous or clingy in new situations, easily loses confidence	☐	☐	☐
Kind to younger children	☐	☐	☐
Often argumentative with adults	☐	☐	☐
Picked on or bullied by other children	☐	☐	☐
Often volunteers to help others (parents, teachers, other children)	☐	☐	☐
Can stop and think things out before acting	☐	☐	☐
Can be spiteful to others	☐	☐	☐
Gets on better with adults than with other children	☐	☐	☐
Many fears, easily scared	☐	☐	☐
Sees tasks through to the end, good attention span	☐	☐	☐

Do you have any other comments or concerns?

Please turn over - there are a few more questions on the other side

Overall, do you think that your child has difficulties in one or more of the following areas: emotions, concentration, behaviour or being able to get on with other people?

No	Yes - minor difficulties	Yes - definite difficulties	Yes - severe difficulties
☐	☐	☐	☐

If you have answered "Yes", please answer the following questions about these difficulties:

- How long have these difficulties been present?

Less than a month	1-5 months	6-12 months	Over a year
☐	☐	☐	☐

- Do the difficulties upset or distress your child?

Not at all	Only a little	Quite a lot	A great deal
☐	☐	☐	☐

- Do the difficulties interfere with your child's everyday life in the following areas?

	Not at all	Only a little	Quite a lot	A great deal
HOME LIFE	☐	☐	☐	☐
FRIENDSHIPS	☐	☐	☐	☐
LEARNING	☐	☐	☐	☐
LEISURE ACTIVITIES	☐	☐	☐	☐

- Do the difficulties put a burden on you or the family as a whole?

Not at all	Only a little	Quite a lot	A great deal
☐	☐	☐	☐

Signature .... Date ....

Mother/Father/Other (please specify:)

Thank you very much for your help

Parent Form
Preschool Level

Social Skills

Rating System

Ages 3-5

Social Skills Questionnaire

Frank M. Gresham and Stephen N. Elliott

Directions

This questionnaire is designed to measure **how often** your child exhibits certain social skills and **how important** those skills are to your child's development. Ratings of problem behaviors are also requested. First, complete the information about your child and yourself.

Student Information

Name___________________________ Date__________
First Middle Last — Month Day Year

School________________ City________________ State__________

Grade________ Birth date________________ Sex: ☐ Female ☐ Male
Month Day Year

Teacher's name______________________________

Ethnic group (optional)

☐ Asian ☐ Indian (Native American)

☐ Black ☐ White

☐ Hispanic ☐ Other______

How many brothers and sisters does this child have at home?

☐ None ☐ 1 ☐ 2 ☐ 3 or more

Parent Information

Name___________________________ Telephone__________
First Middle Last

Address________________ City________________ State__________

Sex: ☐ Female ☐ Male

How are you related to this child?

☐ Mother ☐ Guardian

☐ Father ☐ Other______________

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Form: PP

Next, read each item on pages 2-4 (items 1-49) and think about your child's present behavior. Decide **how often** your child does the behavior described.

If your child **never** does this behavior, circle the **0**.
If your child **sometimes** does this behavior, circle the **1**.
If your child **very often** does this behavior, circle the **2**.

For items 1-39, you should also rate **how important** each of these behaviors is for your child's development.

If it is **not important** for your child's development, circle the **0**.
If it is **important** for your child's development, circle the **1**.
If it is **critical** for your child's development, circle the **2**.

Here are two examples:

	How Often? Never	Sometimes	Very Often	How Important? Not Important	Important	Critical
Shows a sense of humor.	0	1	2	0	1	2
Answers the phone appropriately.	0	1	2	0	1	2

*This parent thought that the child **very often** showed a sense of humor and that showing a sense of humor was **important** to the child's development. This parent also thought that the child **never** answered the phone appropriately and that answering the phone appropriately was **critical** to the child's development.*

There are no right or wrong answers. You may take as much time as you like.
Please do not skip any items.

FOR OFFICE USE ONLY How Often?

C	A	R	S	Social Skills	How Often? Never	Sometimes	Very Often	How Important? Not Important	Important	Critical
				1. Follows your instructions.	0	1	2	0	1	2
				2. Helps you with household tasks without being asked.	0	1	2	0	1	2
				3. Appropriately questions household rules that may be unfair.	0	1	2	0	1	2
				4. Attempts household tasks before asking for your help.	0	1	2	0	1	2
				5. Gives compliments to friends or other children in the family.	0	1	2	0	1	2
				6. Participates in organized group activities.	0	1	2	0	1	2
				7. Politely refuses unreasonable requests from others.	0	1	2	0	1	2
				8. Introduces herself or himself to new people without being told.	0	1	2	0	1	2
				9. Uses free time at home in an acceptable way.	0	1	2	0	1	2
				10. Asks permission before using another family member's property.	0	1	2	0	1	2
				11. Responds appropriately when hit or pushed by other children.	0	1	2	0	1	2
				12. Volunteers to help family members with tasks.	0	1	2	0	1	2
				13. Invites others to your home.	0	1	2	0	1	2
				14. Avoids situations that are likely to result in trouble.	0	1	2	0	1	2
C	A	R	S	SUMS OF HOW OFTEN COLUMNS						

FOR OFFICE USE ONLY How Often? C	A	R	S	Social Skills (cont.)	How Often? Never	Sometimes	Very Often	How Important? Not Important	Important	Critical
				15. Starts conversations rather than waiting for others to talk first.	0	1	2	0	1	2
				16. Keeps room clean and neat without being reminded.	0	1	2	0	1	2
				17. Completes household tasks within a reasonable time.	0	1	2	0	1	2
				18. Controls temper in conflict situations with you.	0	1	2	0	1	2
				19. Controls temper when arguing with other children.	0	1	2	0	1	2
				20. Appropriately expresses feelings when wronged.	0	1	2	0	1	2
				21. Follows rules when playing games with others.	0	1	2	0	1	2
				22. Attends to your instructions.	0	1	2	0	1	2
				23. Shows interest in a variety of things.	0	1	2	0	1	2
				24. Answers the phone appropriately.	0	1	2	0	1	2
				25. Makes friends easily.	0	1	2	0	1	2
				26. Compromises in conflict situations by changing own ideas to reach agreement.	0	1	2	0	1	2
				27. Puts away toys or other household property.	0	1	2	0	1	2
				28. Waits turn in games or other activities.	0	1	2	0	1	2
				29. Receives criticism well.	0	1	2	0	1	2
				30. Congratulates family members on accomplishments.	0	1	2	0	1	2
				31. Follows household rules.	0	1	2	0	1	2
				32. Is self-confident in social situations such as parties or group outings.	0	1	2	0	1	2
				33. Attends to speakers at meetings such as in church or youth groups.	0	1	2	0	1	2
				34. Joins group activities without being told.	0	1	2	0	1	2
				35. Ends disagreements with you calmly.	0	1	2	0	1	2
				36. Is liked by others.	0	1	2	0	1	2
				37. Asks sales clerks for information or assistance.	0	1	2	0	1	2
				38. Communicates problems to you.	0	1	2	0	1	2
				39. Speaks in an appropriate tone of voice at home.	0	1	2	0	1	2
C	A	R	S	SUMS OF HOW OFTEN COLUMNS						

Appendix C:

Teacher-completed questionnaires

Strengths and Difficulties Questionnaire $T^{3/4}$

For each item, please mark the box for Not True, Somewhat True or Certainly True. It would help us if you answered all items as best you can even if you are not absolutely certain or the item seems daft! Please give your answers on the basis of the child's behaviour over the last six months or this school year.

Child's Name .... Male/Female

Date of Birth ....

	Not True	Somewhat True	Certainly True
Considerate of other people's feelings	☐	☐	☐
Restless, overactive, cannot stay still for long	☐	☐	☐
Often complains of headaches, stomach-aches or sickness	☐	☐	☐
Shares readily with other children (treats, toys, pencils etc.)	☐	☐	☐
Often has temper tantrums or hot tempers	☐	☐	☐
Rather solitary, tends to play alone	☐	☐	☐
Generally obedient, usually does what adults request	☐	☐	☐
Many worries, often seems worried	☐	☐	☐
Helpful if someone is hurt, upset or feeling ill	☐	☐	☐
Constantly fidgeting or squirming	☐	☐	☐
Has at least one good friend	☐	☐	☐
Often fights with other children or bullies them	☐	☐	☐
Often unhappy, down-hearted or tearful	☐	☐	☐
Generally liked by other children	☐	☐	☐
Easily distracted, concentration wanders	☐	☐	☐
Nervous or clingy in new situations, easily loses confidence	☐	☐	☐
Kind to younger children	☐	☐	☐
Often argumentative with adults	☐	☐	☐
Picked on or bullied by other children	☐	☐	☐
Often volunteers to help others (parents, teachers, other children)	☐	☐	☐
Can stop and think things over before acting	☐	☐	☐
Can be spiteful to others	☐	☐	☐
Gets on better with adults than with other children	☐	☐	☐
Many fears, easily scared	☐	☐	☐
Sees tasks through to the end, good attention span	☐	☐	☐

Do you have any other comments or concerns?

Please turn over - there are a few more questions on the other side

Overall, do you think that this child has difficulties in one or more of the following areas: emotions, concentration, behaviour or being able to get on with other people?

No	Yes - minor difficulties	Yes - definite difficulties	Yes - severe difficulties
☐	☐	☐	☐

If you have answered "Yes", please answer the following questions about these difficulties:

- How long have these difficulties been present?

Less than a month	1-5 months	6-12 months	Over a year
☐	☐	☐	☐

- Do the difficulties upset or distress the child?

Not at all	Only a little	Quite a lot	A great deal
☐	☐	☐	☐

- Do the difficulties interfere with the child's everyday life in the following areas?

	Not at all	Only a little	Quite a lot	A great deal
PEER RELATIONSHIPS	☐	☐	☐	☐
LEARNING	☐	☐	☐	☐

- Do the difficulties put a burden on you or the class as a whole?

Not at all	Only a little	Quite a lot	A great deal
☐	☐	☐	☐

Signature .... Date ....

Playgroup leader/Nursery teacher/Other (please specify)

Thank you very much for your help

Teacher Form
Preschool Level

Social Skills

Ages 3-5

Rating System Social Skills Questionnaire

Frank M. Gresham and Stephen N. Elliott

Directions

This questionnaire is designed to measure **how often** a student exhibits certain social skills and **how important** those skills are for success in *your* classroom. Ratings of problem behaviors are also requested. First, complete the information about the student and yourself.

Student Information

Student's name______________________ Date______________
First Middle Last Month Day Year

School______________________ City______________ State______

Grade______________ Birth date______________ Sex: ☐ Female ☐ Male
Month Day Year

Ethnic group (optional)

☐ Asian ☐ Indian (Native American)
☐ Black ☐ White
☐ Hispanic ☐ Other______________

Is this student handicapped? ☐ Yes ☐ No

If handicapped, this student is classified as:

☐ Learning-disabled ☐ Mentally handicapped
☐ Behavior-disordered ☐ Other handicap (specify)______________

Teacher Information

Teacher's name______________________ Sex: ☐ Female ☐ Male
First Middle Last

What is your assignment?

☐ Regular ☐ Resource ☐ Self-contained ☐ Other (specify)______________

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Form: TP

Next, read each item on pages 2 and 3 (items 1 - 40) and think about this student's behavior during the past month or two. Decide **how often** the student does the behavior described.

If the student **never** does this behavior, circle the **0**.
If the student **sometimes** does this behavior, circle the **1**.
If the student **very often** does this behavior, circle the **2**.

For items 1 - 30, you should also rate **how important** each of these behaviors is for success in *your* classroom.

If the behavior is **not important** for success in your classroom, circle the **0**.
If the behavior is **important** for success in your classroom, circle the **1**.
If the behavior is **critical** for success in your classroom, circle the **2**.

Here are two examples:

	How Often?			How Important?		
	Never	Sometimes	Very Often	Not Important	Important	Critical
Shows empathy for peers.	0	1	2	0	1	2
Asks questions of you when unsure of what to do in schoolwork.	0	1	2	0	1	2

*This student **very often** shows empathy for classmates. Also, this student **sometimes** asks questions when unsure of schoolwork. This teacher thinks that showing empathy is **important** for success in his or her classroom and that asking questions is **critical** for success.*

Please do not skip any items. In some cases you may not have observed the student perform a particular behavior. Make an estimate of the degree to which you think the student would probably perform that behavior.

Social Skills

FOR OFFICE USE ONLY How Often? C	A	S	Social Skills	How Often? Never	Sometimes	Very Often	How Important? Not Important	Important	Critical
			1. Follows your directions.	0	1	2	0	1	2
			2. Makes friends easily.	0	1	2	0	1	2
			3. Appropriately tells you when he or she thinks you have treated him or her unfairly.	0	1	2	0	1	2
			4. Responds appropriately to teasing by peers.	0	1	2	0	1	2
			5. Appropriately questions rules that may be unfair.	0	1	2	0	1	2
			6. Attempts classroom tasks before asking for your help.	0	1	2	0	1	2
			7. Controls temper in conflict situations with adults.	0	1	2	0	1	2
			8. Gives compliments to peers.	0	1	2	0	1	2
			9. Participates in games or group activities.	0	1	2	0	1	2
			10. Produces correct schoolwork.	0	1	2	0	1	2
			11. Helps you without being asked.	0	1	2	0	1	2
			12. Introduces himself or herself to new people without being told.	0	1	2	0	1	2
			13. Accepts peers' ideas for group activities.	0	1	2	0	1	2
			14. Cooperates with peers without prompting.	0	1	2	0	1	2
			15. Waits turn in games or other activities.	0	1	2	0	1	2
			16. Uses time appropriately while waiting for your help.	0	1	2	0	1	2
C	A	S	SUMS OF HOW OFTEN COLUMNS						

Social Skills (cont.)

FOR OFFICE USE ONLY How Often? C	A	S	Item	How Often? Never	Sometimes	Very Often	How Important? Not Important	Important	Critical
			17. Says nice things about himself or herself when appropriate.	0	1	2	0	1	2
			18. Uses free time in an acceptable way.	0	1	2	0	1	2
			19. Acknowledges compliments or praise from peers.	0	1	2	0	1	2
			20. Controls temper in conflict situations with peers.	0	1	2	0	1	2
			21. Follows rules when playing games with others.	0	1	2	0	1	2
			22. Finishes class assignments within time limits.	0	1	2	0	1	2
			23. Compromises in conflict situations by changing own ideas to reach agreement.	0	1	2	0	1	2
			24. Initiates conversations with peers.	0	1	2	0	1	2
			25. Invites others to join in activities.	0	1	2	0	1	2
			26. Receives criticism well.	0	1	2	0	1	2
			27. Puts work materials or school property away.	0	1	2	0	1	2
			28. Responds appropriately to peer pressure.	0	1	2	0	1	2
			29. Joins ongoing activity or group without being told to do so.	0	1	2	0	1	2
			30. Volunteers to help peers with classroom tasks.	0	1	2	0	1	2
C	A	S	SUMS OF HOW OFTEN COLUMNS						

Problem Behaviors

FOR OFFICE USE ONLY How Often? E	I	Item	How Often? Never	Sometimes	Very Often
		31. Has temper tantrums.	0	1	2
		32. Fidgets or moves excessively.	0	1	2
		33. Argues with others.	0	1	2
		34. Disturbs ongoing activities.	0	1	2
		35. Says nobody likes him or her.	0	1	2
		36. Appears lonely.	0	1	2
		37. Is aggressive toward people or objects.	0	1	2
		38. Disobeys rules or requests.	0	1	2
		39. Shows anxiety about being with a group of children.	0	1	2
		40. Acts sad or depressed.	0	1	2
E	I	SUMS OF HOW OFTEN COLUMNS			

Do not make importance ratings for items 31 - 40

Stop. Please check to be sure all items have been marked.

Appendix D:

Experimenter-completed checklist

Hillside Behavior Rating Scale[1]

For each of the seven categories listed below, please circle the <u>one</u> number which <u>best describes</u> the child's behavior during the testing session:

1. *Gross Motor Activity*
   1 Average in gross motor activity. (No excessive running, no restlessness, or fidgety behavior).
   2 Somewhat restless. May have movements of the hands, fingers, or arms. Does not have excessive gross motor activity such as running, climbing, inability to sit still.
   3 Restless and fidgety. Can sit for appropriate periods of time, but squirms in chair, moves about in chair, does not sit still.
   4 Very restless and fidgety.
   5 Hyperactive, but can be controlled. Has difficulty sitting down. Gets up, but can be brought back.
   6 Very hyperactive, very difficult to control. Difficult to get back.
   7 Severe hyperactivity. Cannot be controlled; runs around, climbs, cannot sit for any length of time.

2. *Distractibility and Concentration*
   1 Is goal-oriented, can maintain interest in tasks.
   2 Slightly distractible, but is goal-oriented and can finish tasks with minimal pressure.
   3 Quite distractible; finishes tasks only with considerable pressure; shows minimal goal-oriented behavior.
   4 Extremely distractible, cannot sustain attention for more than a few seconds, regardless of external pressure.
   5 Never starts or gets involved in anything presents to him and therefore cannot be rated.

3. *Frustration Tolerance*
   1 Average reaction to frustration. Can accept setting of limits without showing either indifference or emotional upset.
   2 Has difficulty relinquishing demands. Persists when wants something; may whine or carry on verbally but no emotional upset.
   3 Exaggerated reaction to frustration, but stops after a short time; may cry, scream, have a brief tantrum.
   4 Exaggerated reaction which continues for extended periods of time (beyond 10 minutes). Screams, crying, tantrums.
   5 Catastrophic reaction to even minor frustrations. Has violent tantrums.

4. *Cooperation*
   1 (Good) Follows instructions well and easily; complies without urging.
   2 (Fair) Complies with little repetition or urging.
   3 (Poor) Follows instructions after considerable pressure and intervention on the examiner's part.
   4 (Very poor) Performs only with inordinate amount of pressure, limit setting, and/or threats.
   5 (Nil) Does not comply no matter how much pressure or urging is exerted.

5. *Interest in Tasks*
   1 child is eager to try tasks; is consistently easily stimulated.
   2 On the whole child is eager to try tasks; on occasion loses interest.
   3 Child is interested sometimes only not so much other times.
   4 Child rarely shows interest in tasks.
   5 Child shows no interest in the tasks at all.

6. *Attention Seeking Devices*
   Please consider so-called "negative" attention-seeking devices like the following: needless requests or questions, silly verbal behavior, clowning, showing off, shouting, testing limits, tattling, crying, tantrums, hiding, playing sick.
   1 Child never seeks attention through devices similar to the ones described above.
   2 Child rarely seeks attention through these devices.
   3 Child occasionally employs such devices.
   4 Child frequently resorts to such devices.
   5 These devices are practically constant and characterize the manner in which the child behaves.

7. *Impulse Control*
   1 Child has good control of her/his impulses. Never acts impulsively
   2 Child usually has good control of his/her impulses, but acts impulsively on rare occasions.
   3 Child has some control of impulses, but at times acts impulsively.
   4 Child has poor control of impulses and often acts impulsively.
   5 Child is extremely impulsive. She/he very seldom, if ever, stops to think about the consequences of her/his actions.

[1] Gittelman & Klein, 1985

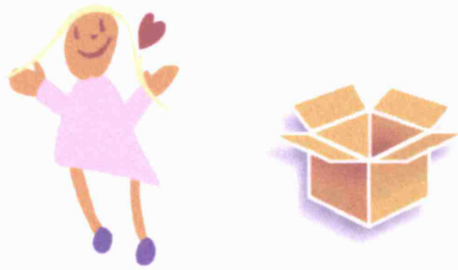
Appendix E:

Theory of mind and inhibitory control tasks

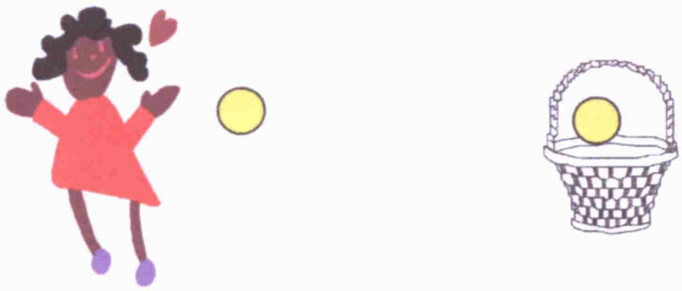
The Sally-Anne Task

This is Sally. Sally has a basket.

This is Anne. Anne has a box.



Sally has a marble. She puts the marble in her basket.



Now she goes out for a walk.

While Sally is out, Anne takes the marble out of the basket and puts it into the box.

Now Sally comes back. She wants to play with her marble.

Where will Sally look for her marble?

Where is the marble really?

Where was the marble at the beginning of the story?

The Smarties Task

What do you think is in this box? (Child should say “smarties”)

Let’s see what’s inside...

(Open box to reveal contents is a pencil, as above. Close the box again.)

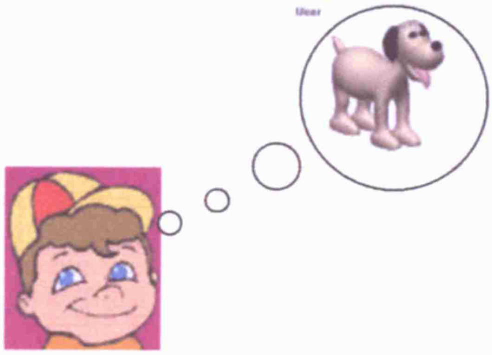
Now what do you think is inside the box?

When I first showed you this box, before we opened it, what did you think was inside?

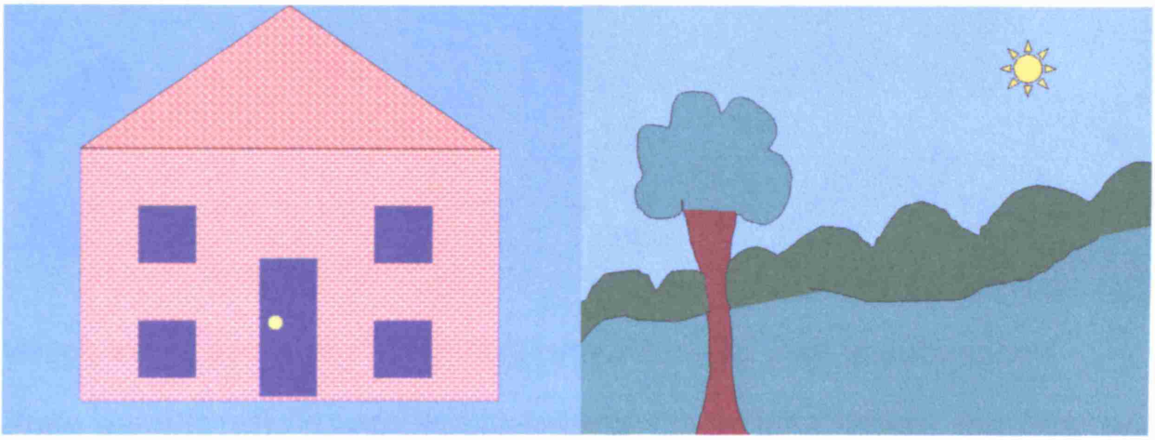
If I showed this box to *(insert name of child’s friend/ key-worker)*, what would s/he think was inside?

Not Own Belief Task

This is Sam. Sam wants to find his puppy.



This is the house... ...and this is the garden.



The puppy might be in the house, or he might be in the garden.

Where do you think the puppy is, in the house or in the garden?

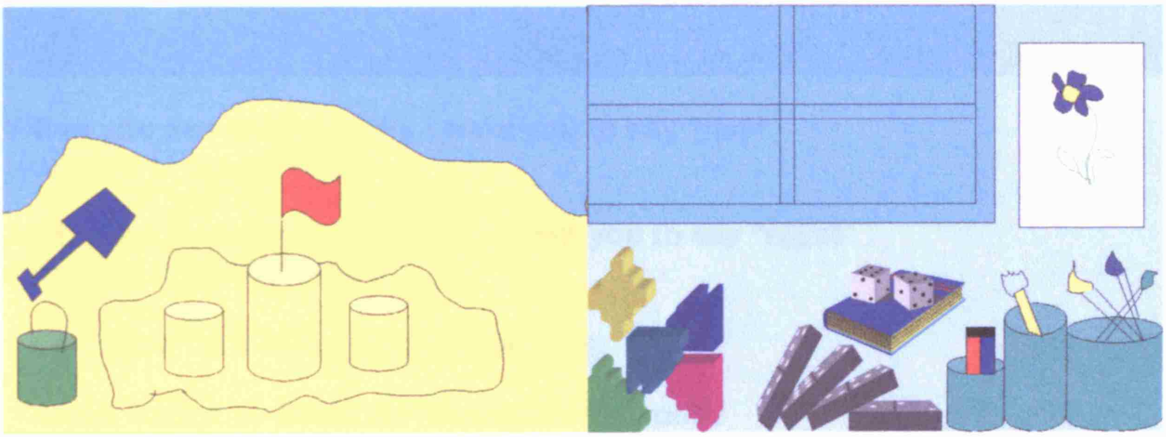
Sam thinks his puppy is in (opposite location to child's choice), he doesn't think he's in (other location)

Where will Sam look for his puppy, in the house or in the garden?

Not Own Desire Task

This is Rosie.

At Rosie's school they can play with sand in the sandpit or puzzles in the classroom...



Which would you prefer to do, play with puzzles or play with the sand?

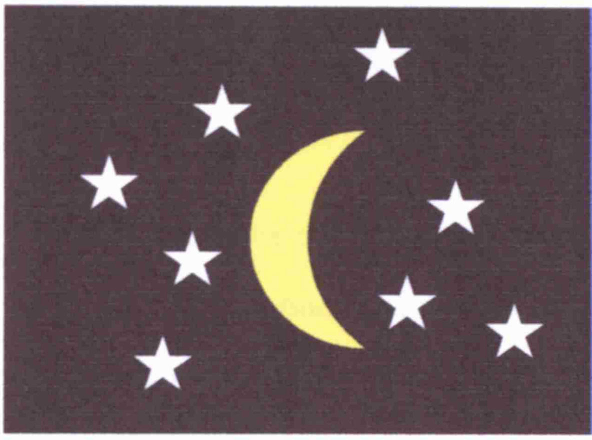
Rosie wants to play (in opposite location to child's preferred choice), she doesn't want to play (in location of child's preferred choice)

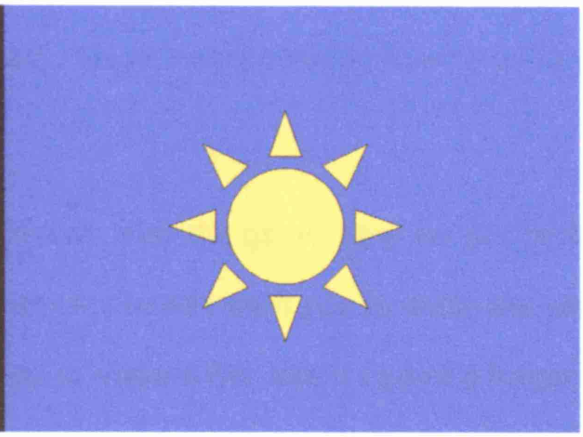
Where will Rosie go and play?

The Day/Night Task

A

B





When you see this card (A), **I want you to say "day"**
(Ask child to repeat "day")

And when you see this card (B), **I want you to say "night"**
(Ask child to repeat "night")

- Show card A - No instructions given
- If hesitation, **What do you say for this one?**
- Show card B – No instructions given
- If hesitation, **What do you say for this one?**

Feedback is given and task repeated until the child has correctly responded to each card at least once. Next, proceed to 2 training trials in which feedback is given and rules repeated until the child has responded correctly at least once. The following 14 trials presented in the following order:

Trial 3 **Day**

Trial 4 **Night**

Trial 5 **Day**

Trial 6 **Night**

Trial 7 **Night**

Trial 8 **Day**

Trial 9 **Day**

Trial 10 **Night**

Trial 11 **Day**

Trial 12 **Night**

Trial 13 **Night**

Trial 14 **Day**

Trial 15 **Night**

Trial 16 **Day**

Luria's Hand Game

(Model a fist action). **Can you show me how to make a fist with your hand like this?**

If successful, praise the child. (Point a finger). **Good, now show me how to point your finger"**

If correct, praise the child. **Good. Here's how we play the game. First we put both our hands behind our backs; now when I show my hand I want you to make the same shape as me. So if I make a fist I want you to make a fist, and if I point a finger you point a finger too"**

After 3 correct responses to each gesture, presented in random order (with feedback and repeated rules where necessary):

That was very good. Now the game gets a bit harder. This time, if I point a finger then I want you to show a fist, and if I show a fist I want you to point a finger. This time we are making different shapes.

What do you do if I show a fist? (demonstrate) **And if I point a finger?** (demonstrate)

Repeat instructions, with feedback about performance, until 4 consecutive correct responses were given.

Test/experimental phase conducted in the following order:

1 Fist	6 Fist
2 Finger	7 Fist
3 Finger	8 Finger
4 Fist	9 Finger
5 Finger	10 Fist

Appendix F:

Sub-scales of the SSRS in “at risk” versus “low risk” groups

Appendix F: Mean scores (standard deviations) on SSRS sub-scales at age 3:
"At risk" versus "low risk" groups

	"Low risk" group (N=48)	"At risk" group (N=72)		
Sub-scale	Mean (SD)	Mean (SD)	Effect size	Significant difference?
Parent-rated co-operation	12.91 (2.57) N=47	10.80 (3.73) N=70	0.65	***
Parent-rated assertion	15.57 (2.78) N=47	13.36 (3.78) N=70	0.62	***
Parent-rated responsibility	11.66 (3.58) N=47	11.26 (14.06) N=70	0.04	n.s.
Parent-rated self control	14.47 (2.76) N=47	11.13 (3.00) N=70	1.00	***
Teacher-rated co-operation	14.64 (3.87) N=42	11.89 (3.57) N=45	0.70	***
Teacher-rated assertion	11.74 (4.28) N=42	9.36 (4.34) N=45	0.53	*
Teacher-rated self-control	13.98 (3.17) N=42	9.91 (4.57) N=45	0.93	***

*p<0.05; ***p<0.001

Appendix G:

Boys versus girls within the "at risk" group on individual items of the SDQ "Conduct problems" sub-scale

Appendix G: Mean scores (standard deviations) on SDQ conduct problems sub-scale at age 3: Boys versus girls within "at risk" group

Sub-scale	Boys (N=30) Mean (SD)	Girls (N=42) Mean (SD)	Effect size	Significant difference?
Parent: "Often has temper tantrums or hot tempers"	1.20 (0.71) N=30	1.07 (0.76) N=41	0.18	n.s.
Parent: "Generally obedient, usually does what adults request"	0.90 (0.41) N=29	0.93 (0.53) N=40	0.06	n.s.
Parent: "Often fights with other children or bullies them"	0.77 (0.57) N=30	0.41 (0.63) N=41	0.58	*
Parent: Often argumentative with adults"	1.13 (0.68) N=30	0.90 (0.63) N=41	0.35	n.s.
Parent: "Can be spiteful to others"	0.97 (0.73) N=29	0.73 (0.55) N=40	0.37	n.s.
Teacher: "Often has temper tantrums or hot tempers"	0.74 (0.81) N=23	0.75 (0.73) N=36	0.01	n.s.
Teacher: "Generally obedient, usually does what adults request"	1.13 (0.69) N=23	1.22 (0.59) N=36	0.14	n.s.
Teacher: "Often fights with other children or bullies them"	0.50 (0.74) N=22	0.29 (0.57) N=35	0.33	n.s.
Teacher: Often argumentative with adults"	0.35 (0.57) N=23	0.42 (.60) N=36	0.12	n.s.
Teacher: "Can be spiteful to others"	0.68 (0.78) N=22	0.60 (0.74) N=35	0.11	n.s.

*p<0.05

Appendix H:

"Followed-up" versus "not followed-up" children across whole sample: Demographics, cognition and behaviour

English as a second language by follow-up status

Crosstab

Count

		followed up?		Total
		no	yes	
Is english your first language?	no	21	44	65
	yes	39	110	149
Total		60	154	214

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.844[b]	1	.358		
Continuity Correction[a]	.567	1	.451		
Likelihood Ratio	.831	1	.362		
Fisher's Exact Test				.409	.225
Linear-by-Linear Association	.840	1	.359		
N of Valid Cases	214				

a. Computed only for a 2x2 table

b. 0 cells (.0%) have expected count less than 5. The minimum expected count is 18.22.

Employment status by follow-up status

Crosstab

Count

		followed up?		Total
		no	yes	
employed?	no	34	73	107
	yes	23	78	101
Total		57	151	208

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	2.117[b]	1	.146		
Continuity Correction[a]	1.689	1	.194		
Likelihood Ratio	2.129	1	.145		
Fisher's Exact Test				.163	.097
Linear-by-Linear Association	2.107	1	.147		
N of Valid Cases	208				

a. Computed only for a 2x2 table

b. 0 cells (.0%) have expected count less than 5. The minimum expected count is 27.68.

Live in partner vs No live-in partner by follow-up status

Crosstab

Count

		followed up?		Total
		no	yes	
live-in partner?	no	16	58	74
	yes	42	94	136
Total		58	152	210

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	2.056[b]	1	.152		
Continuity Correction[a]	1.619	1	.203		
Likelihood Ratio	2.108	1	.147		
Fisher's Exact Test				.196	.101
Linear-by-Linear Association	2.046	1	.153		
N of Valid Cases	210				

a. Computed only for a 2x2 table

b. 0 cells (.0%) have expected count less than 5. The minimum expected count is 20.44.

Ethnic minority status by follow-up status

Crosstab

Count

		followed up?		Total
		no	yes	
ethnic origin	non-white	29	68	97
	white	31	87	118
Total		60	155	215

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.348[b]	1	.555		
Continuity Correction[a]	.191	1	.662		
Likelihood Ratio	.347	1	.556		
Fisher's Exact Test				.647	.331
Linear-by-Linear Association	.346	1	.556		
N of Valid Cases	215				

a. Computed only for a 2x2 table

b. 0 cells (.0%) have expected count less than 5. The minimum expected count is 27.07.

Furthest level of education attended by follow-up status

Crosstab

Count

		followed up?		Total
		no	yes	
furthest level of education attended	0	2		2
	up to age 16	13	14	27
	GCSEs	11	19	30
	GNVQ, A-level/equivalent	7	19	26
	further education	22	96	118
Total		55	148	203

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	17.098[a]	4	.002
Likelihood Ratio	16.547	4	.002
Linear-by-Linear Association	15.239	1	.000
N of Valid Cases	203		

a. 2 cells (20.0%) have expected count less than 5. The minimum expected count is .54.

Highest SES status of household by follow-up status

Crosstab

Count

		followed up?		
		no	yes	Total
highest SES of household	1	6	7	13
	2	8	36	44
	3	4	23	27
	4	3	11	14
	5	7	11	18
	6	1	1	2
	7	1	2	3
	9	1	4	5
Total		31	95	126

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	8.560[a]	7	.286
Likelihood Ratio	8.077	7	.326
Linear-by-Linear Association	.123	1	.726
N of Valid Cases	126		

a. 9 cells (56.3%) have expected count less than 5. The minimum expected count is .49.

Appendix H: Mean scores (standard deviations) on cognitive and behavioural measures at age 3: Followed-up versus not followed-up children

	Followed up (N=156)	Not followed up (N=62)		
Measure	Mean (SD)	Mean (SD)	Effect size	Significant difference?
NVIQ	95.04 (17.76) N=149	90.97 (17.09) N=59	0.23	n.s.
Verbal ability	94.04 (18.88) N=148	93.89 (18.82) N=57	0.08	n.s.
ToM	1.88 (1.20) N=144	2.12 (1.19) N=56	0.20	n.s.
IC	.67 (.78) N=144	.63 (.70) N=56	0.05	n.s.
Parent-rated conduct problems	2.74 (1.99) N=153	2.68 (1.92) N=56	0.03	n.s.
Parent-rated hyperactivity	3.09 (2.31) N=153	3.29 (2.21) N=56	0.09	n.s.
Parent-rated social skills	99.73 (15.59) N=153	99.83 (17.31) N=53	0.01	n.s.
Teacher-rated conduct problems	1.50 (1.72) N=122	1.29 (2.21) N=49	0.11	n.s.
Teacher-rated hyperactivity	3.02 (2.35) N=122	2.55 (2.12) N=49	0.21	n.s.
Teacher-rated social skills	93.03 (16.49) N=93	96.36 (13.67) N=42	0.21	n.s.
Experimenter-rated hyperactivity	11.24 (5.62) N=152	11.19 (4.80) N=59	0.09	n.s.

Appendix I:

"Followed-up" versus "not followed-up" children within "at risk" group: Demographics, cognition and behaviour

English as a second language by follow-up status

Crosstab

Count

		followed up? no	followed up? yes	Total
Is english your first language?	no	13	15	28
	yes	8	36	44
Total		21	51	72

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	6.608[b]	1	.010		
Continuity Correction[a]	5.312	1	.021		
Likelihood Ratio	6.526	1	.011		
Fisher's Exact Test				.016	.011
Linear-by-Linear Association	6.517	1	.011		
N of Valid Cases	72				

a. Computed only for a 2x2 table

b. 0 cells (.0%) have expected count less than 5. The minimum expected count is 8.17.

Employment status by follow-up status

Crosstab

Count

		followed up? no	followed up? yes	Total
employed?	no	16	30	46
	yes	2	20	22
Total		18	50	68

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	5.047[b]	1	.025		
Continuity Correction[a]	3.813	1	.051		
Likelihood Ratio	5.753	1	.016		
Fisher's Exact Test				.038	.021
Linear-by-Linear Association	4.973	1	.026		
N of Valid Cases	68				

a. Computed only for a 2x2 table

b. 0 cells (.0%) have expected count less than 5. The minimum expected count is 5.82.

Live-in partner vs No live-in partner by follow-up status

Crosstab

Count

		followed up? no	followed up? yes	Total
live-in partner?	no	9	27	36
	yes	10	23	33
Total		19	50	69

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.243[b]	1	.622		
Continuity Correction[a]	.050	1	.824		
Likelihood Ratio	.243	1	.622		
Fisher's Exact Test				.788	.411
Linear-by-Linear Association	.239	1	.625		
N of Valid Cases	69				

a. Computed only for a 2x2 table

b. 0 cells (.0%) have expected count less than 5. The minimum expected count is 9.09.

Ethnic minority status by follow-up status

Crosstab

Count

		followed up? no	followed up? yes	Total
ethnic origin	non-white	13	22	35
	white	8	29	37
Total		21	51	72

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	2.097[b]	1	.148		
Continuity Correction[a]	1.413	1	.235		
Likelihood Ratio	2.110	1	.146		
Fisher's Exact Test				.197	.117
Linear-by-Linear Association	2.068	1	.150		
N of Valid Cases	72				

a. Computed only for a 2x2 table

b. 0 cells (.0%) have expected count less than 5. The minimum expected count is 10.21.

Furthest level of education attended by follow-up status

Crosstab

Count

		followed up? no	followed up? yes	Total
furthest level of education attended	up to age 16	6	5	11
	GCSEs	3	9	12
	GNVQ, A-level/equivalent	3	8	11
	further education	5	27	32
Total		17	49	66

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	6.502[a]	3	.090
Likelihood Ratio	6.024	3	.110
Linear-by-Linear Association	5.269	1	.022
N of Valid Cases	66		

a. 3 cells (37.5%) have expected count less than 5. The minimum expected count is 2.83.

Highest SES of household by follow-up status

Crosstab

Count

		followed up?		
		no	yes	Total
highest SES of household	1	2		2
	2		9	9
	3		6	6
	4		4	4
	5	1	3	4
	6		1	1
	7	1		1
	9	1	2	3
Total		5	25	30

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	19.800[a]	7	.006
Likelihood Ratio	18.716	7	.009
Linear-by-Linear Association	.738	1	.390
N of Valid Cases	30		

a. 14 cells (87.5%) have expected count less than 5. The minimum expected count is .17.

Appendix I: Mean scores (standard deviations) on cognitive and behavioural measures at age 3: Followed-up versus not followed-up children in "at risk" group

Measure	Followed up (N=51) Mean (SD)	Not followed up (N=21) Mean (SD)	Effect size	Significant difference?
NVIQ	90.69 (18.45) N=48	86.60 (17.42) N=20	0.23	n.s.
Verbal ability	86.94 (19.23) N=48	84.79 (14.62) N=19	0.12	n.s.
ToM	1.80 (1.19) N=46	1.83 (1.25) N=18	0.03	n.s.
IC	.54 (.78) N=46	.39 (.61) N=18	0.20	n.s.
Parent-rated conduct problems	4.65 (1.79) N=51	4.42 (1.78) N=19	0.13	n.s.
Parent-rated hyperactivity	3.76 (2.45) N=51	4.26 (2.51) N=19	0.20	n.s.
Parent-rated social skills	94.22 (16.45) N=51	96.63 (19.36) N=19	0.14	n.s.
Teacher-rated conduct problems	2.90 (2.15) N=40	2.83 (2.94) N=18	0.03	n.s.
Teacher-rated hyperactivity	4.07 (2.67) N=40	3.89 (2.59) N=18	0.07	n.s.
Teacher-rated social skills	85.47 (16.51) N=32	90.00 (15.01) N=13	0.28	n.s.
Experimenter-rated hyperactivity	12.47 (6.56) N=49	11.85 (5.97) N=20	0.10	n.s.

Appendix J:

“Followed-up” versus “not followed-up” children within “low risk” group: Demographics, cognition and behaviour

English as a second language by follow-up status

Crosstab

Count

		followed up? no	followed up? yes	Total
Is english your first language?	no	4	8	12
	yes	12	24	36
Total		16	32	48

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.000[b]	1	1.000		
Continuity Correction[a]	.000	1	1.000		
Likelihood Ratio	.000	1	1.000		
Fisher's Exact Test				1.000	.644
Linear-by-Linear Association	.000	1	1.000		
N of Valid Cases	48				

a. Computed only for a 2x2 table

b. 1 cells (25.0%) have expected count less than 5. The minimum expected count is 4.00.

Employment status by follow-up status

Crosstab

Count

		followed up? no	followed up? yes	Total
employed?	no	5	13	18
	yes	11	19	30
Total		16	32	48

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.400[b]	1	.527		
Continuity Correction[a]	.100	1	.752		
Likelihood Ratio	.406	1	.524		
Fisher's Exact Test				.753	.379
Linear-by-Linear Association	.392	1	.531		
N of Valid Cases	48				

a. Computed only for a 2x2 table

b. 0 cells (.0%) have expected count less than 5. The minimum expected count is 6.00.

Live-in partner vs No live-in partner by follow-up status

Crosstab

Count

		followed up? no	followed up? yes	Total
live-in partner?	no	2	12	14
	yes	14	20	34
Total		16	32	48

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	3.227[b]	1	.072		
Continuity Correction[a]	2.130	1	.144		
Likelihood Ratio	3.552	1	.059		
Fisher's Exact Test				.098	.069
Linear-by-Linear Association	3.160	1	.075		
N of Valid Cases	48				

a. Computed only for a 2x2 table

b. 1 cells (25.0%) have expected count less than 5. The minimum expected count is 4.67.

Ethnic minority status by follow-up status

Crosstab

Count

		followed up?		Total
		no	yes	
ethnic origin	non-white	5	16	21
	white	9	16	25
Total		14	32	46

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.801[b]	1	.371		
Continuity Correction[a]	.329	1	.566		
Likelihood Ratio	.811	1	.368		
Fisher's Exact Test				.522	.285
Linear-by-Linear Association	.784	1	.376		
N of Valid Cases	46				

a. Computed only for a 2x2 table

b. 0 cells (.0%) have expected count less than 5. The minimum expected count is 6.39.

Furthest level of education attended by follow-up status

Crosstab

Count

		followed up?		Total
		no	yes	
furthest level of education attended	up to age 16	1	2	3
	GCSEs	1	1	2
	GNVQ, A-level/equivalent	3	3	6
	further education	10	24	34
Total		15	30	45

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	1.235[a]	3	.745
Likelihood Ratio	1.183	3	.757
Linear-by-Linear Association	.371	1	.543
N of Valid Cases	45		

a. 6 cells (75.0%) have expected count less than 5. The minimum expected count is .67.

Highest SES of household by follow-up status

Crosstab

Count

		followed up?		Total
		no	yes	
highest SES of household	1	3	4	7
	2	4	6	10
	3	2	8	10
	4	2	2	4
	5	2	1	3
Total		13	21	34

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	2.746[a]	4	.601
Likelihood Ratio	2.841	4	.585
Linear-by-Linear Association	.156	1	.693
N of Valid Cases	34		

a. 8 cells (80.0%) have expected count less than 5. The minimum expected count is 1.15.

Appendix J: Mean scores (standard deviations) on cognitive and behavioural measures at age 3: Followed-up versus not followed-up children in "low risk" group

	Followed up (N=32)	Not followed up (N=16)		
Measure	Mean (SD)	Mean (SD)	Effect size	Significant difference?
NVIQ	96.66 (18.52) N=32	92.94 (15.84) N=16	0.21	n.s.
Verbal ability	98.50 (19.20) N=32	104.07 (15.80) N=15	0.31	n.s.
ToM	1.88 (1.34) N=32	2.33 (.98) N=15	0.36	n.s.
IC	.66 (.70) N=32	.80 (.78) N=15	0.19	n.s.
Parent-rated conduct problems	1.00 (.76) N=32	1.00 (.82) N=16	0.00	n.s.
Parent-rated hyperactivity	2.41 (1.62) N=32	1.81 (1.68) N=16	0.36	n.s.
Parent-rated social skills	107.06 (13.56) N=32	104.87 (13.84) N=15	0.16	n.s.
Teacher-rated conduct problems	.22 (.42) N=32	.00 (.00) N=16	0.62	*
Teacher-rated hyperactivity	2.19 (2.42) N=32	1.75 (1.44) N=16	0.21	n.s.
Teacher-rated social skills	100.68 (14.00) N=28	99.40 (12.74) N=15	0.10	n.s.
Experimenter-rated hyperactivity	9.75 (4.44) N=32	10.63 (4.46) N=16	0.21	n.s.

*p<0.05

Appendix K:

Children in school versus children still at nursery on all measures at time 2

Appendix K: Mean scores (standard deviations) on cognitive and behavioural measures at age 4: Children at nursery vs children at school at time 2

Measure	Nursery (N=96) Mean (SD)	School (N=60) Mean (SD)	Effect size	Significant difference?
NVIQ	94.71 (17.74) N=92	95.58 (17.93) N=57	0.05	n.s.
Verbal ability	95.74 (19.42) N=91	91.33 (17.82) N=57	0.23	n.s.
ToM	1.89 (1.16) N=89	1.87 (1.28) N=55	0.02	n.s.
IC	.58 (.75) N=89	.80 (.80) N=55	0.28	n.s.
Parent-rated conduct problems	2.77 (2.05) N=93	2.68 (1.90) N=60	0.05	n.s.
Parent-rated hyperactivity	3.17 (2.27) N=93	2.97 (2.38) N=60	0.09	n.s.
Parent-rated social skills	98.38 (15.00) N=93	101.83 (16.38) N=60	0.22	n.s.
Teacher-rated conduct problems	1.63 (1.85) N=76	1.28 (1.49) N=46	0.20	n.s.
Teacher-rated hyperactivity	3.12 (2.34) N=76	2.85 (2.39) N=46	0.11	n.s.
Teacher-rated social skills	92.93 (17.89) N=57	93.19 (14.22) N=36	0.02	n.s.
Experimenter-rated hyperactivity	11.54 (5.97) N=94	10.74 (5.01) N=58	0.14	n.s.

Appendix L:

Discrepancies in associations between cognition and behaviour at time 1 in “followed-up” versus “not followed-up” children

Appendix L: Discrepancies in time 1 analyses of the larger sample versus followed-up sample.

1. **Regression equation in table 3.3 of chapter 3:**
    - DV: Teacher-rated conduct problems
    - Step 1: NVIQ, Step 2: Verbal ability

Larger sample: Step 1: R-squared = 0.06, F (1, 158) = 9.67, Beta = -.24, $p<0.01$.
Step 2: R-squared change = 0.05, F change (2, 157) = 9.26, Beta = -.27, $p<0.01$.

Followed-up: Step 1: R-squared = 0.04, F (1, 113) = 4.69, Beta = -.20, $p<0.05$.
Step 2: R-squared change = 0.03,F change (2, 112) = 3.00,Beta = -.19, p=0.086, n.s.

2. **Regression equation in table 3.4 of chapter 3:**
    - DV: Experimenter-rated hyperactivity
    - Step 1: Verbal ability, Step 2: NVIQ

Larger sample: Step 1: R-squared = 0.08, F (1, 202) = 18.39, Beta = -.30, $p<0.001$.
Step 2: R-squared change = 0.02, F change (2, 201) = 4.60, Beta = -.17, $p<0.05$.

Followed-up: Step 1: R-squared = 0.11, F (1, 145) = 18.19, Beta = -.33, $p<0.001$.
Step 2: R-squared change = 0.02, F change (2, 144) = 2.47,Beta = -.15, p=0.118, n.s.

3. **Regression equation in table 3.5 of chapter 3:**
    - DV: Parent-rated conduct problems
    - Step 1: Parent, teacher, exptr-rated hyperactivity, Step 2: Verbal ability

Larger sample: Step 1: R-squared = 0.17, F (3, 156) = 10.51, Beta = .34, .12, .04, $p<0.001$.
Step 2: R-squared change = 0.02, F change (4, 155) = 3.94, Beta = -.16, $p<0.05$.

Followed-up: Step 1: R-squared = 0.16, F (3, 111) = 7.24, Beta = .29, .14, .10, $p<0.001$.
Step 2: R-squared change = 0.02, F change (4, 110) = 2.62,Beta = -.15, p=0.109, n.s.

4. **<u>Pearson's correlations between teacher-rated conduct problems and IC in table 3.8 of chapter 3:</u>**

Larger sample: r = -.19, n.s. (N=156)
Followed-up: r = -.20, p<0.05. (N=112)

5. **<u>Pearson's correlations between parent-rated hyperactivity and IC in table 3.8 of chapter 3:</u>**

Larger sample: r = -.17, n.s. (N=192)
Followed-up: r = -.19, p<0.05. (N=142)

6. **<u>Regression equation in table 3.9 of chapter 3:</u>**
   - DV: Teacher-rated hyperactivity
   - Step 1: IC, Step 2: ToM

Larger sample: Step 1: R-squared = 0.06, F (1, 154) = 10.24, Beta = -.25, p<0.01.
Step 2: R-squared change = 0.03, F change (2, 153) = 4.47, Beta = -.18, p<0.05.

Followed-up: Step 1: R-squared = 0.07, F (1, 110) = 7.90, Beta = -.26, p<0.01.
Step 2: R-squared change = 0.03, F change (2, 109) = 3.45,Beta= -.19, p=0.066, n.s.